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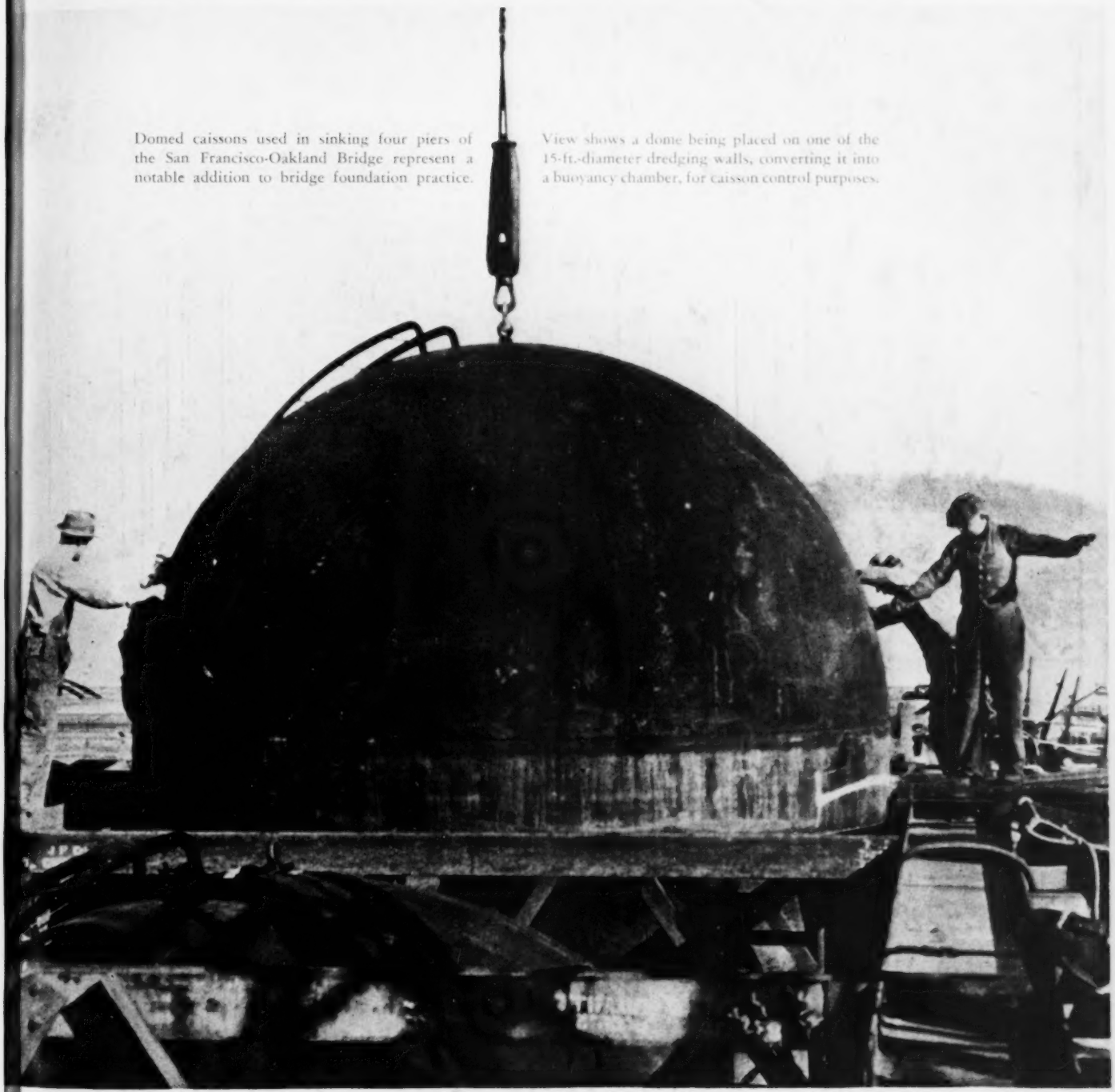
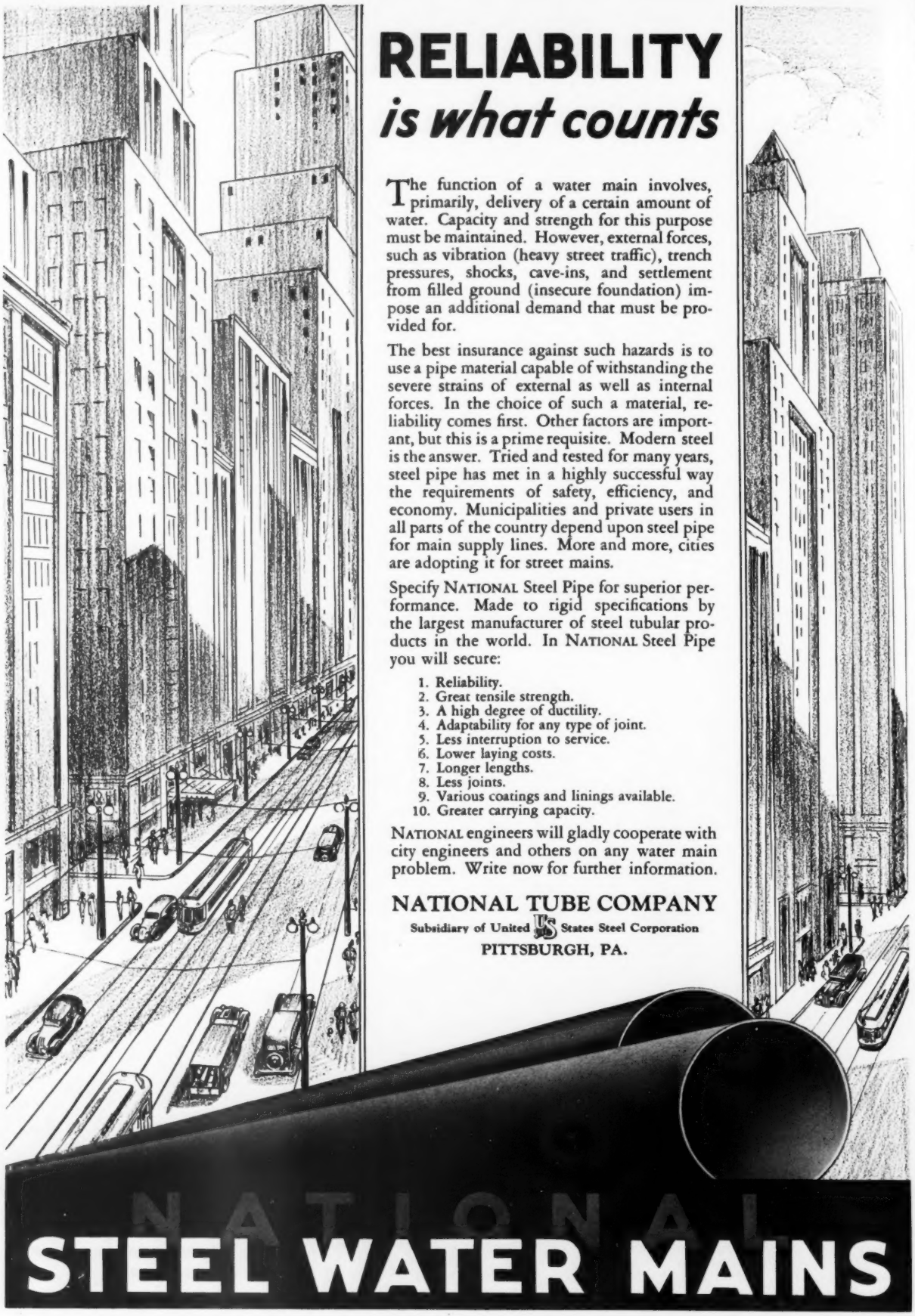
Domed caissons used in sinking four piers of the San Francisco-Oakland Bridge represent a notable addition to bridge foundation practice. View shows a dome being placed on one of the 15-ft.-diameter dredging walls, converting it into a buoyancy chamber, for caisson control purposes.



In This Issue: *How the Code Affects the Contractor*

. . . A Digest and Catechism



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In the News

REPORTS from Washington are to the effect that the Rivers and Harbors bill, providing for maintenance and new dredging work in almost every section of the country, will be given no consideration by this Congress.

IN LOUISIANA, the state supreme court has upheld the right of the highway commission to issue bonds for the $7,000,000 Mississippi River bridge at Baton Rouge. It is an approved PWA project. Bids will be asked within 30 days.

PLANS are under way in Washington for a great national home-repair and modernization program, as an aid to improvement in the capital-goods industries. A billion dollars has been mentioned, to be provided by banks, mortgage companies and other agencies, with some sort of federal guarantee to the lenders.

THE TVA has met its first cement requirements for the Norris and Wheeler dams by purchasing 315,000 barrels at $2.10. The order was divided among six different companies.

THE COMMITTEE ON ROADS of the House of Representatives has proposed a bill authorizing $400,000,000 for highway construction, to be expended under the same plan as has been used for the road funds provided under the Recovery Act.

AUTHORIZATION by the St. Francis Levee Board of the sale of $552,000 of bonds to the PWA will permit completion of the board's flood-protection work along the west bank of the Mississippi River from the Missouri line to Helena, Ark.

ANOTHER DRAFT of an engineers' code has been presented to the NRA by the code committee of the American Society of Civil Engineers. It is an attempt to harmonize the proposals made in a draft of a code prepared by the NRA legal staff with those put forward by engineers who considered some of the NRA proposals unworkable. See an abstract in the news pages of this issue, and also a brief editorial.

NEW YORK PARKS are undergoing a thorough overhauling under the new park régime. In Central Park the zoo is being remodeled, the famous sheepfold building is being made into a moderate-price restaurant, and plans are being drafted for playgrounds on an old reservoir site. At other parks new bath houses are being built and moderate-price restaurants are being established. The three-block Chrystie-Forsythe St. site near Manhattan Bridge will be a park, thus effectively disposing of the many plans for low-cost housing projects that have been developed for this slum-cleared site. Much of this work has been done by CWA labor.

In This Issue

NEW CAISSON-SINKING METHODS are being used in constructing four of the deep piers for the San Francisco-Oakland bridge. Cellular structures with 15-ft. diam. dredging wells comprise the caissons. For flotation and for control during sinking, the wells are capped with domes and charged with compressed air, to act as buoyancy chambers. This remarkable job, involving a caisson 92x197 ft. in plan, another sunk in 105 ft. of water (and successfully sealed two weeks ago), and rock depths up to 220 ft., is the subject of the second article in the series on this outstanding project.

MODEL STUDIES in a small flume at the University of Michigan and on a large scale at the Waterways Experiment Station at Vicksburg have shown that the levels of Lakes Michigan and Huron may be controlled by installing six or eight submerged sills, with vertical upstream faces, in the St. Clair River above the mouth of Black River. Major W. F. Heavey, Corps of Engineers, describes the studies and the plan of the proposed work.

THE DISASTROUS debris flows which occurred in Los Angeles County Jan. 1 following a heavy rainstorm were made the subject of detailed study by the division of irrigation of the U. S. Bureau of Agricultural Engineering. An article condensed from the final report is presented in this issue.

THREE GREAT dam-building projects in the northwest are just getting under way —Bonneville and Grand Coulée on the Columbia River and Fort Peck on the Upper Missouri River in Montana. An editor's visit to the sites of these operations has resulted in an article which outlines the general features of the work, the preliminary operations and the difficulties of putting men to work quickly on projects whose designs are still in the developmental stages.

Coming Articles:

ONE OF THE COUNTRY'S most modern and completely equipped airports was put into service recently at New Orleans, La. Construction included an unusual seawall and a large amount of hydraulic fill. A description of the seawall and filling operation, of landing field and air-terminal structures will be published in next week's issue.

THE AIR ROADS ARE ALWAYS OPEN

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New York

April 5, 1934

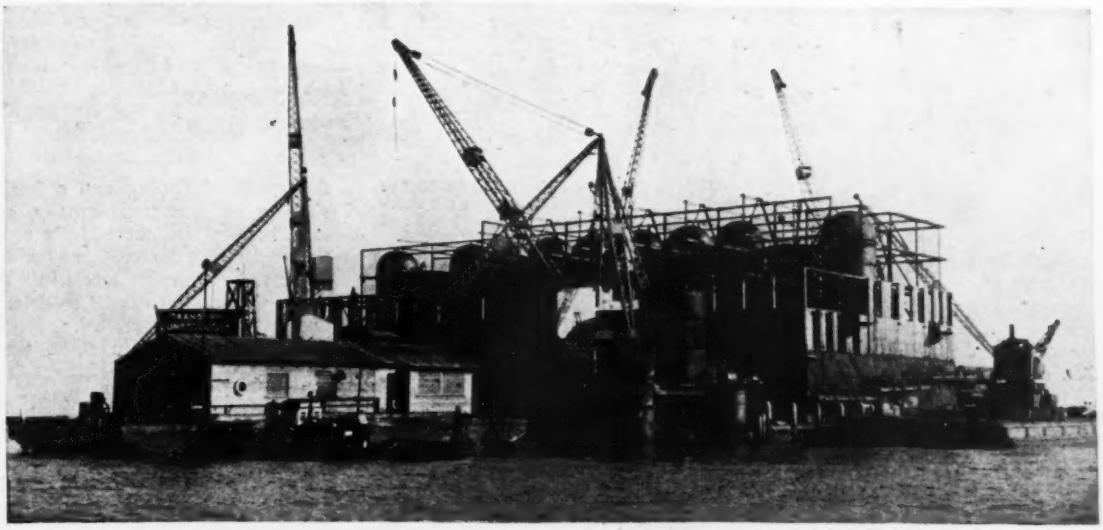


FIG. 1—THIS LARGE CAISSON, almost 100x200 ft. in plan, for the central anchorage, is being sunk 180 ft. to rock. Note the domes on some of the wells. The four derricks handle materials and are used for dredging.

Bay Bridge Foundations Built With Unique Domed Caissons

West Channel piers of San Francisco-Oakland Bridge introduce improvement in open-dredging process by maintaining domes over well tops to permit control by compressed air during sinking—Domes raised by adding sections to wells as sinking advances

By C. H. Purcell, Chas. E. Andrew and Glenn B. Woodruff

Respectively, Chief Engineer, Bridge Engineer and Engineer of Design, San Francisco-Oakland Bay Bridge.

CONSTRUCTION of the largest and deepest bridge foundations ever attempted in the deep water of a swift-flowing tideway, for the West Channel crossing of the San Francisco-Oakland Bay bridge, was necessitated by the physical characteristics of the site. In addition to designing the foundations, it was considered equally essential to plan and develop the construction procedure to be used by the contractor, so as to minimize the risk and facilitate the underwriting of surety bonds. The general characteristics of the bridge project, its history and development, were described in detail in *Engineering News-Record*, March 22, 1934, p. 371.

Foundation conditions involved rock depths up to a maximum of 220 ft. at one of the five pier sites, and at another location the tidal channel is 105 ft. deep to mud line. The principal physical and geological features at the individual pier locations are shown in the West Channel profile, Fig. 2. The only foundation-placement method that has ever reached comparable depths has employed open dredging; consequently only caissons with large and well-placed dredging wells were considered. In view of the heavy lateral forces caused by current, wind, cable pulls and probable earthquake shocks, it was evident that if single unbraced piers were used, they must have large horizontal dimensions.

The vertical dredging wells, forming half of the pier cross-section and extending the full caisson height, if left in the permanent structure and partly filled with water rather than concrete, would decrease the cost and weight of the pier mass, as compared with solid piers of the same dimensions. The walls of the cells were amply strong to support the pier load and to take horizontal shear; hence the main body of the pier base might be logically designed as a cellular structure.

With timber comparatively inexpensive and available in any required sizes, this material was naturally suggested for the caissons. In their usual form the walls around dredging wells of such caissons are constructed of two lines of

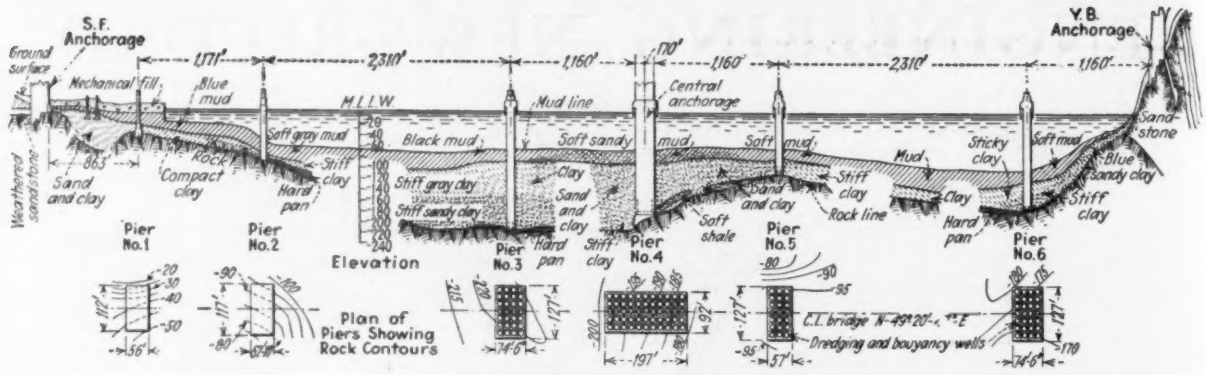


FIG. 2—FOUNDATION CONDITIONS at West Channel pier sites. Note the maximum depth of 220 ft. to rock at pier 3 and the 105-ft. depth of water at pier 6.

structural timbers, with the space between filled with concrete. The combined weight of timber and concrete is about twice that of the displaced water, so that the top of the concrete available as backing for the timber is always below water level a distance equal to one-half the caisson draft. For example, at 100-ft. draft the top of the concrete would be 50 ft. below water level, and the timber walls above the concrete would be required to withstand this head as a cofferdam. In this form of construction not only the outside walls but the walls of all the dredging pockets have to be calked against water pressure and protected against teredo attack.

The water pressure due to this height involves heavy wall timbers and a large amount of bracing between the walls. This bracing would have interfered with the placing of the reinforcing steel and with the desirable continuity of the concrete construction. In case the dredging wells were to be water-filled, the construction would involve transferring vertical pier loads through timber to the seal, which was considered objectionable. Two timber walls plus concrete of sufficient area to carry all stresses would have resulted in such a total thickness of wall that dredging operations under the cutting edges would have been difficult. For these reasons, timber caissons were not adopted.

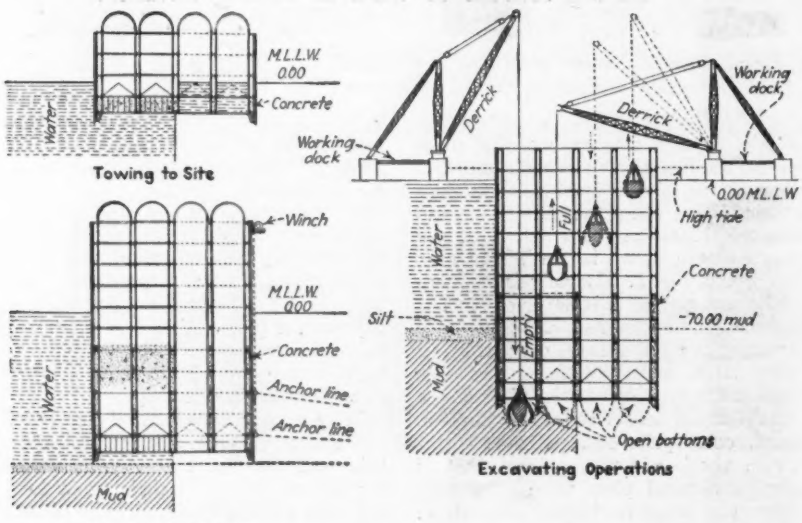
Ample flotation for a cellular pier may be obtained if the vertical dredging wells are used as flotation chambers. This has frequently been accomplished by the use of temporary (or false) bottoms placed near the level of the cutting edge. There are several objections to the use of false bottoms. For use at a depth of 100 ft. they must be extremely heavy, and their removal, to permit dredging, has frequently proved a difficult operation, even with lighter framing and less depth of water. Also, in landing on mud such a caisson is liable to skid on the bottom, and in settling in the mud there is always danger that the material displaced by the downward motion of the caisson may move more freely on one side than the other, with the result of tipping and a horizontal shifting of position. Finally, as the false bottoms are successively removed, the underlying material may rise suddenly and to varying levels in different wells; the support cannot be determined nor accurately controlled. Moreover, the engineers had in mind that the caisson of the Mid-Hudson Bridge (*ENR*, Feb. 12, 1931, p. 275) was upset at the beginning of dredging while false bottoms were still being removed, the depth of water being 60 ft. and the width of caisson 60 ft. Pier 6 has a width of 74.5 ft., with a water depth of 105 ft., so that the ratio of the depth to the width is nearly 1½, whereas the ratio at the Mid-Hudson Bridge was only 1. For these reasons it seemed desirable to avoid, if possible, the use of false bottoms.

Consideration was also given to the sand-island scheme, which has been successfully used in founding deep piers at the Martinez Bridge of the Southern Pacific Railroad (*ENR*, Jan. 30, 1930, p. 174) and is being used for the channel piers of the New Orleans Bridge now under construction. The island method for pier 4 would require the placement of a cylindrical steel shell not less than 225 ft. in diameter and more than 100 ft. high. For pier 6 the shell might be smaller in diameter but would be 130 ft. high. Also, the right to use this method is claimed under existing patents.

After investigating these previously used methods, Daniel E. Moran, of Moran & Proctor, member of the consulting board, proposed the cylinder method (Fig. 3), which has been adopted. In this method, flotation is secured both by displacing water from the dredging wells and by carrying the exterior cofferdam above the concrete surface. In place of false bottoms, the cylinders are "domed" at their tops, and the water is displaced to any desired level by compressed air. The cylindrical shape is used as most satisfactory for resisting air pressure. The steel cylinders are part of the permanent construction and also serve as forms.

Among the advantages of this method are the stability and control that may be obtained during both the flotation period and the sinking stage. In the

FIG. 3—DOMED-CYLINDER METHOD of foundation construction, showing three principal steps in process, from caisson flotation at the fabricating dock to dredging in mud.



usual false-bottom design an effort is made to keep the weight of the concrete per foot of caisson height equal to the weight of water displaced. In this case the center of gravity of the caisson and the center of displacement coincide, leaving only the metacentric height as a safety factor against tipping. In the cylinder method, with a reasonable thickness of concrete between cylinders, the area of dredging wells is about one-half the area of the caisson. This necessitates keeping the top of the concrete below water level a distance equal to about one-quarter of the draft.

The caisson is landed by reducing the air pressure in the cylinders. Even in very soft material there is practically no displacement of mud under the cutting edge, and as a result there is no tendency for the caisson to tip or displace. Any lists can be corrected by adjustment of the air pressure.

Further advantages of the method, are: (1) at any time while the cutting edge is above the limiting depth for the pneumatic method, air locks may be placed on the domes, allowing workmen to enter the cylinders to remove obstructions at the cutting-edge level; (2) at any time when the domes are in position, they serve as an effective brake against the sudden listing of the caisson; (3) air pressure may be introduced at any time to correct a list of the caisson; (4) when sealing the caisson on sloping rock, the air pressure may be used to keep the caisson level.

Patent situation

While this appears to have been the first time this method has been employed, it is interesting to note that the idea has been developed by different individuals working independently. In 1873 a patent (No. 137,659) was issued to David Cunningham for airtight doors closing the tops of openings in cellular blocks of masonry as a partial means for floating the blocks. In 1913, Allen C. Rush, who had this particular bridge project in mind, was granted a patent (No. 1,079,517) for the use of metal cylinders to form dredging wells, and domes to close same, as aids to flotation. In preparing a bid for the New Orleans Bridge, James S. Miller, of the Dravo Contracting Co., developed a method using cylinders and domes, and was granted a patent (No. 1,899,346) on the use of same in righting a caisson or controlling its level after the landing of the caisson.

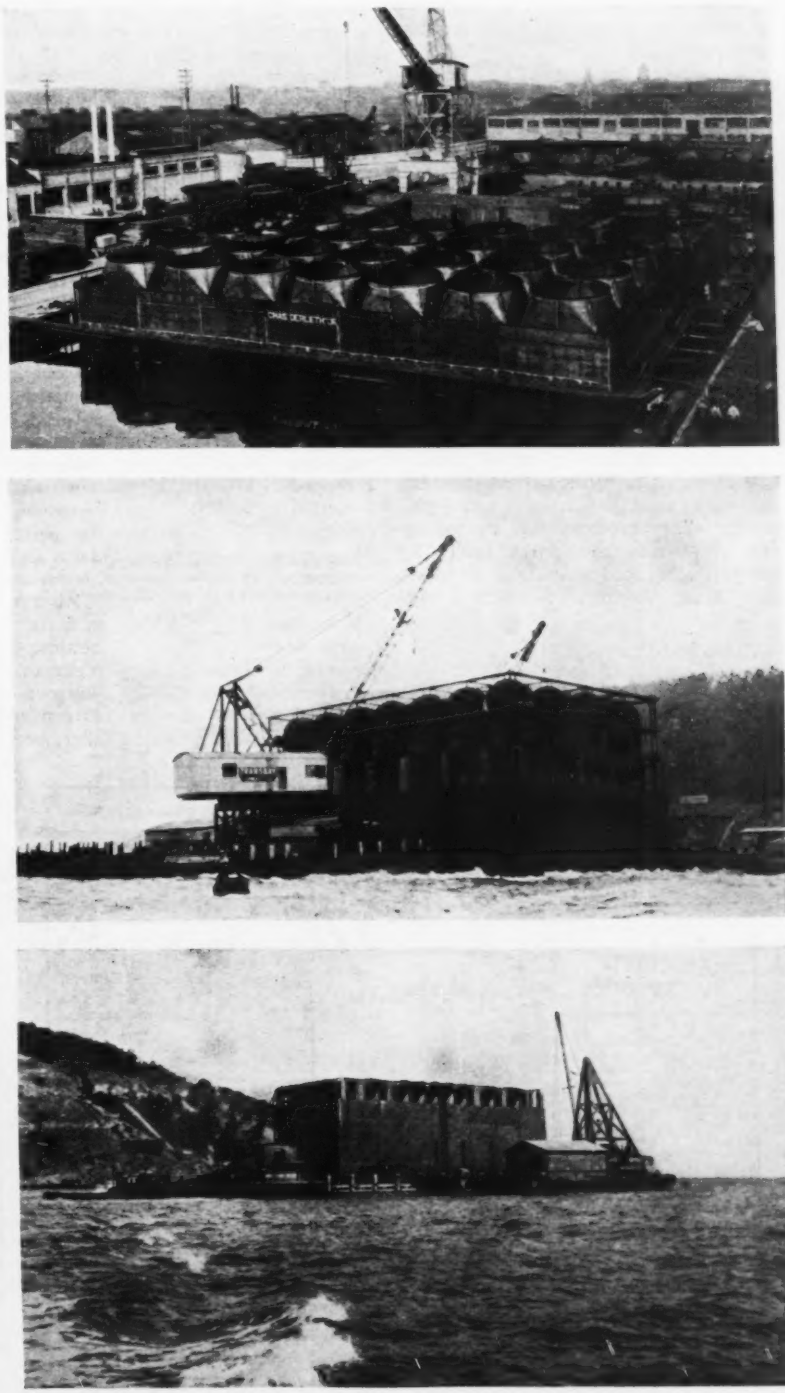
At about the same time, Mr. Moran, having no knowledge of Mr. Miller's application, made an application for the method as used, and found, as had Mr. Miller, that in view of the patents to Cunningham and Rush (as well as the patent to Miller), no broad claims could be obtained.

Design of the caisson

The cutting-edge sections of the caissons consist of box girders in both directions, leaving openings 15 ft. square. These girders are 13 ft. 6 in. deep for caissons Nos. 3, 5 and 6, and those for No. 4 are 4 ft. deeper. These girders are closed at the bottom so that the section itself is a floating body. They were designed to take care of launching stresses and also for the stresses caused by a "standard wave." Adapter sections connect the square openings between the girders to the cylinders (Fig. 4, top).

The exterior cofferdams consist of 10-in. vertical and 4-in. (creosoted) diagonal sheeting; the outer layer is calked. These thicknesses are greater than required for strength but were used to provide a reserve in case of

FIG. 4—THREE STAGES of caisson work. On the shipways with adapter sections in place (top), anchored at the site with floating equipment in position and cylinders high above cofferdam (center), and ready for concrete to be placed between the dredging wells for the first step in sinking (bottom).



collision and also to secure such rigidity that there would be no "working" of the calking.

The steel wales and struts were designed with strength sufficient: (1) to resist such heads that would not necessitate the expelling of water lower than 10 ft. above the cutting edge; (2) to permit at least 10 per cent of the domes to be removed for raising the cylinders; and (3) to allow the cutting edge to penetrate 15 ft. into the mud at time of landing. The use of steel removed all timber from the interior of the caisson, replaced about 50 per cent of its section in reinforcing steel, and made erection more rapid.

In designing the caissons (Fig. 5), attention was given to simplification of detail and as much duplication of fabrication as possible. Caissons 3 and 6 are duplicates except for some wale sections. Caisson 5 is the same with the omission of one row of cylinders. A 15-ft. diameter of cylinder was used throughout, and a 10-ft. spacing of wales was maintained. All details were developed with a view to facilitating the placing of concrete, and all light lacing and similar details were completely eliminated.

Except for a few special connections, the design drawings left the choice between welding and riveting to the contractor, who, in general, elected to weld all connections except minor details. The box girders were assembled in the shop in sections 17½ ft. long, and duplication made it economical to set up jigs in which the parts could be clamped and accurately held in position during welding. Fabricated sections were then assembled on shipways and the joints between the sections welded. After launching, and while still at the shipyard, the adapter sections, the first 45-ft. length of cylinder and the domes were placed, and the steel wales and exterior sheeting were erected to a height of 60 ft. above the girders.

Sinking procedure

As far as possible, the contract drawings and specifications described all essentials of the permanent work and left all construction details, such as anchors, staging, etc., to be developed by the contractor subject to the engineers' approval as to adequacy.

Anchors—One of the first construction problems was that of holding the caissons in position against a current of 7½ m.p.h. Because of the water depths, any guide-frames of reasonable dimensions would have required auxiliary anchors. Further, it would not have been safe for the blocking between the guide frames and the caissons to bear on the cofferdam above the concrete backing so that adjustment of the blocking would have to be made by diver. The contractor therefore decided to anchor directly to the caisson. The layout (Fig. 6) for pier 3 may be considered as typical.

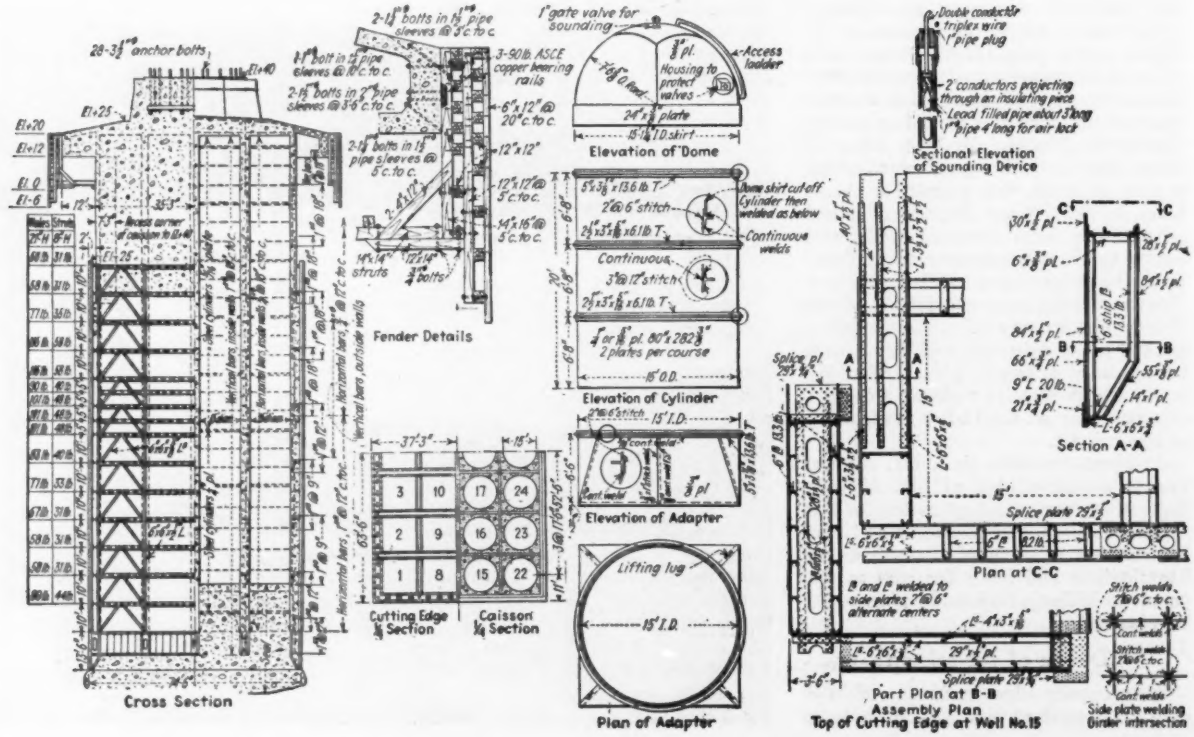
Precast T-shaped concrete anchors, weighing 18 to 25 tons each, were equipped with jetting nozzles along the lower edge. These anchors, with the necessary cable attachments, were moved to the sites by derrick barge and located in exact position by transits from the triangulation points. After lowering to the mud they were jetted until their tops were below the bay bottom. Each anchor is connected to a 2-in. bridge rope of 165-ton breaking strength. Near the caisson this rope connects to an 8-part, 1-in. line, with a lead line connected to a winch at the top of the caisson.

The anchors are placed about 300 ft. from the caisson and as a result the tension in the lines is only slightly affected by the 6-ft. tide. Also, with the long lengths of cable, the pull on the anchor is nearly horizontal and the lifting tendency minimized. The entire system has proved efficient, and no difficulty has been experienced in holding the caissons.

Working Docks—Depth of water to mud line was the determining factor in providing the type of construction equipment to be used at the different sites. At piers 3 and 4 the contractor elected to erect working platforms on timber piles. The 105-ft. depth of water at pier 6 dictated the use of floating equipment, and the construction schedule, which called for practical completion of pier 6 before the start of pier 5, permitted a program for re-using the floating equipment from pier 6 in sinking the caisson at the latter site.

In constructing the working platforms it was necessary to build individual supporting cylinders to carry the concentrated loads of the stiff-leg der-

FIG. 5—DETAILS of caisson, cutting edge, cylinders and domes, as used in sinking the foundations of San Francisco-Oakland Bridge.



ricks. At pier 4 the two working docks are 40x180 ft. in plan and rest on four-pile bents spaced at 18 ft. The untreated timber piles vary from 120 to 125 ft. in length and were driven about 40 ft. into the mud bottom. At the top (El. 16) they are connected with heavy timber framing, and diagonal timber bracing extends to a second set of horizontal timbers at water line. The deck consists of 3-in. timber planking laid on the diagonal with a second 2-in. timber topping in the opposite diagonal to provide lateral stiffness in resisting the force of the tide. These working docks are not connected to the caissons and are not used in any way to assist in maintaining the caissons in position.

Within the area of the working platform at pier 4 are the special foundations for the four stiff-leg derricks. These foundations consist of 8-ft.-diameter steel cylinders, three per derrick, driven into the mud and dredged out. After dredging, seven timber piles were driven inside each cylinder to refusal, and it was then filled up with concrete to the top at El. 25, the level of the base of the derrick. Timber struts, 24x24 in. in section, and cable ties are used to brace these cylinders together in a triangular foundation unit. The two working docks at pier 3 are similar in design, but about one-half the size and support two derricks. The derricks used on the docks are of 3-drum electrically operated type with 120-ft. boom, 50-ft. mast and 25-ton capacity.

To prevent damage of the caissons from ramming and to provide a walkway, particularly at those sunk only with the use of floating equipment, a heavy timber fender system was provided. At the piers where working docks were built, these floating timber fenders close the two ends between the docks. At the other two sites they inclose the entire four sides of the caisson, leaving a clear space of about 7 ft., and are effective in breaking wave action. The fenders are held in position by anchors and the steel cylinders at each end and are not connected to the caissons.

The bridge center line crosses the San Francisco-Oakland ferry lanes, with a traffic of 500 boats daily, and also crosses the main steamship lane. This condition caused apprehensions of collisions, especially in foggy weather, and led to the adoption of the extreme precautions. The U. S. District Engineer designated the area around the site of each caisson as a temporary anchorage. The corners of these areas were marked with lighted buoys. Fog signals with distinctive characteristics are provided at each pier.

Sinking Procedure—As illustrative of the general sinking procedure, the chronology of caisson 4 at the central anchorage is outlined from the day it was launched until its cutting edge was more than 30 ft. into the mud bottom:

Aug. 11: Caisson launched.

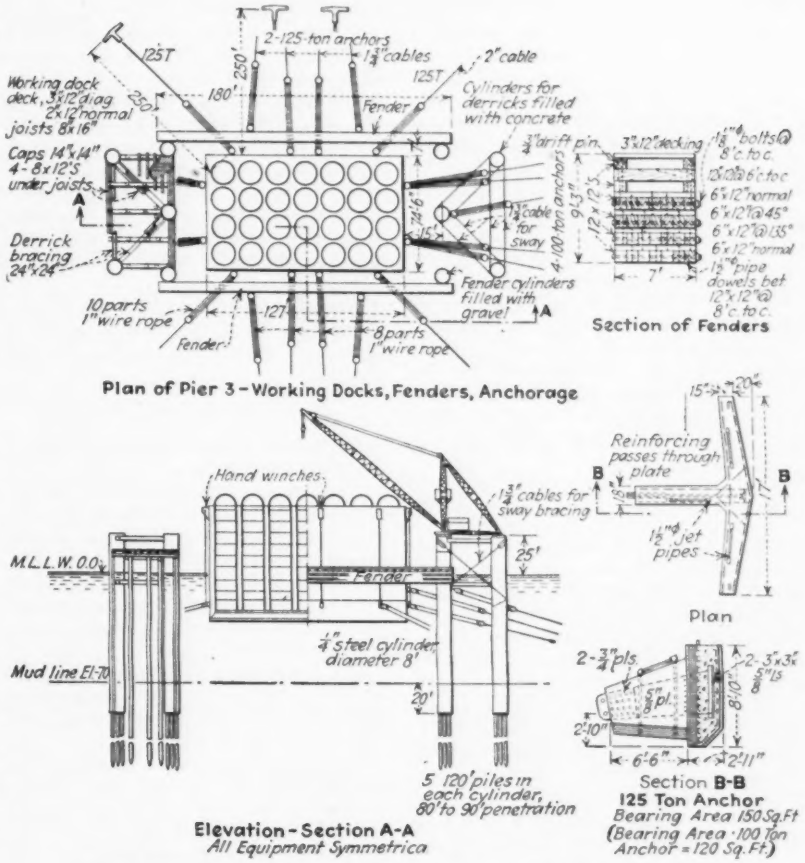


FIG. 6—CONCRETE ANCHORS hold the caisson in position at the site. Derricks with special foundations are mounted on working docks except at piers 5 and 6, where floating derricks are used. Timber fenders prevent ramming.

Aug. 11-Nov. 8: Erection of adapters steel wales and struts, cylinders and timber cofferdam to a height of 67.5 ft. above cutting edge, and placing of domes.

Nov. 8: Caisson towed to site, draft 20 ft.

Nov. 8-14: Anchoring caisson.

Nov. 14-27: 10,123 cu.yd. of concrete placed, bringing concrete to 44 ft. above cutting edge, with a 55-ft. draft. Air pressure 17 lb.

Nov. 27-Dec. 19: Raising cylinders and cofferdam 40 ft. to 107.5 ft. above cutting edge.

Dec. 19-22: 2,820 cu.yd. of concrete added, bringing concrete to 54 ft. above cutting edge, draft 60 ft. Air pressure 22 lb.

Dec. 22: Caisson landed on mud by releasing air to 13.6 lb. Caisson sank to El. –78.6, or 8 ft. into mud.

Dec. 22-29: 5,514 cu.yd. of concrete added, bringing concrete to 73 ft. above cutting edge. Cutting edge at El. –82.3. During this period air was released in half the cylinders, water being pumped in as air was released.

Jan. 2-3: 1,730 cu.yd. concrete placed, bringing it to 83.5 ft. above cutting edge.

Jan. 10-17: 7,638 cu.yd. concrete, top to 106.5 ft. above cutting edge. Cutting edge at El.–94.0, or 25 ft. into the mud.

Jan. 17-26: Raise cylinders to 129 ft. above cutting edge. Air completely released.

Jan. 23: Cutting edge at El. –98.0.

Jan. 26-29: 3,048 cu.yd. concrete placed, bringing it to 117.5 ft. above cutting edge.

The general procedure on the other caissons has been similar to that for No. 4. Since the areas of the other caissons are smaller, the time for each lift of concrete has been less, the average placement about 1,200 cu.yd. per day. On account of the greater water depth at No. 6, the air pressure reached a maximum of 42 lb., and a head of 29.8 ft. occurred on the cofferdam.

Referring to Fig. 5, it will be noted that the domes have a 24-in. skirt. In raising the cylinders, the first operation was to cut off the domes by burning off 2 in. at the skirt connection. Two 20-ft. lengths of cylinders were then added, the dome replaced (Fig. 7) and the three joints welded. This operation required 23 days for the 55 cylinders. The structural-steel frame and timber cofferdam were raised at the same time.

There is less chance of the caisson listing or becoming displaced if there is no motion of the mud in either direc-

tion under the cutting edge. If the air pressure is reduced too far, there is a tendency to draw material under the cutting edge. To avoid such occurrence, after the landing of the caisson, water is pumped into the cylinders as the air is released to keep a constant pressure at the cutting-edge level. To determine accurately the water and mud heights within the cylinders, the sounding device shown in Fig. 5 was developed.

Excavation—After the air is released in all cylinders, the domes are removed and further sinkage gained by dredging with 4-yd. clamshell buckets operated by the derricks on the platforms or barges. Permission of the War Department was obtained to dispose of the material by dumping it outside the caissons, and no barging is required.

Pier 2 construction

Although caisson operations were not used at pier 2, its construction is a part of the West Channel foundation work. At this site, on the San Francisco pierhead line, the rock slopes about 20 ft. in the diagonal dimension of the pier base. The overlying material was comparatively soft, so that a caisson with a level cutting edge would come to bearing on a corner with practically no side support. All conditions seemed best met by an open cofferdam.

A timber frame, trussed in all directions, was erected on shipways, launched and towed to the site. In the meantime, the site had been dredged to a depth of 80 ft. The timber bracing unit was placed in position and loaded until the bottom wales reached rock at El. –80. Steel sheetpiling for the cofferdam was then set and driven to rock. Excavation was completed and the bottom cleaned by jetting, combined with suction pumping, until the discharge from the suction lines showed clear water. The rock surface was given a final inspection by diver.

Concrete was placed by 4-yd. bottom-dump buckets in a continuous 10-day pour from the bottom to El. –9, containing 18,600 cu.yd.

FIG. 7—PLACING A DOME after adding a 40-ft. lift of cylinder. These domes are burned off and welded back on for each lift.

Construction equipment

The major units of floating construction equipment are:

Two floating derricks, each on a separate barge, full revolving, electrically operated, three drums, 105-ft. boom, capacity of 25 tons at 50-ft. radius, 250 hp. Two steam-derrick barges, 110-ft. boom, 35-ton capacity and two steam revolving-derrick barges, 40-ft. boom, 10-ton capacity.

Two compressor plants, each containing one 1,300-ft. machine driven by a 300-hp. motor, and a 650-ft. reserve unit driven by a diesel engine.

Concrete is batched at a plant on the Oakland pier and loaded into mixer barges. Each barge contains eighty 3½-cu.yd. batches, aggregate and cement in separate containers, a tank of mixing water and mixing equipment consisting of four 3½-cu.yd. truck-type mixers. The barge is towed to the site, and the concrete mixed and delivered by a conveyor-belt system to the contractor's receiving barge. The concrete is received in a 3½-yd. hopper, from which it is discharged into a 3½-yd. skip. This skip is hoisted and discharges into a 3½-yd. hopper, which discharges into either of two concrete pump hoppers. The concrete passes through the pumps and is delivered into the caissons through holes bored through the cofferdam. This procedure allows concrete placing to proceed simultaneously with work on the cofferdams. Each pump has a capacity of about 40 cu.yd. per hour and handles concrete with a 2-in. slump. All concrete is consolidated by internal-type pneumatic vibrators. The concrete mixture contains five sacks of concrete per cubic yard and has a w/c ratio of 0.80 to 0.85. The average 28-day strength of test cylinders is more than 3,000 lb. per sq.in.

FIG. 8—TOP VIEW of the nest of 55 domes on the central-anchorage caisson. The hand winches along the left side are for adjusting the anchor lines.

Pier superstructure

The center anchorage, pier 4, extends 282 ft. above water, and will sustain the unbalanced cable pull of 10,700 tons and also support the side-span suspended trusses. On piers 3, 5 and 6 the tops of the cellular walls are tied together with a mat of reinforced concrete, above which concrete pedestals rise to El. +40.0, to support the steel towers.

Adequate and economical pier-fender design was a serious problem. Upon completion of the preliminary designs of these piers, it was found that impact from a vessel would have comparatively little effect because of the large mass of the pier, and the problem therefore became one of damaging the vessel as little as possible. The final design (Fig. 5) consists of (1) a comparatively flexible timber fender that will cushion minor impacts and fail under any considerable blow; and (2) a concrete cutting edge placed above high water, which will puncture a ship's hull above the water line and allow a considerable crushing of the hull before the ship strikes the main part of the pier. This concrete cutting edge is cantilevered from the pier and the timber fender suspended from it. The result is a comparatively inexpensive type of fender construction.

Construction schedule

To reduce interest charges to a minimum, the contract prescribes a rapid schedule, which the contractor expects to better. The contract schedule and the contractor's estimate are:

Pier No.	Contract Schedule	Contractor's Schedule
2	Mar. 15, 1934	Dec. 1, 1933
3	Oct. 5, 1934	Sept. 1, 1934
4	Mar. 15, 1935	Feb. 1, 1935
5	Oct. 5, 1934	Sept. 15, 1934
6	Aug. 15, 1934	May 1, 1934

Personnel

The contract for the five piers, Nos. 2 to 6, is being executed by the Transbay Construction Co., of which C. F. Swigert is president, J. A. MacEachern general manager, Ben Cook superintendent, and C. P. Dunn chief engineer. I. O. Jahlstrom is resident engineer for the state.

The administrative and engineering organization of the San Francisco-Oakland Bay Bridge was listed in detail in the previous article, *ENR*, March 22, 1934, p. 377.

The caissons were fabricated by the Moore Dry Dock Co.; the cylinders were furnished by the Western Pipe and Steel Co., and the structural-steel wales and struts by the Judson-Pacific Co.

Lake-Level Control by Submerged Sills

Model studies confirm general plan and give design data for submerged sills in St. Clair River, to check flow and raise levels of Lakes Michigan and Huron

By W. F. Heavey
Major, Corps of Engineers, U. S. Engineers Office, Cleveland, Ohio

THE QUESTION of raising the levels of Lakes Michigan and Huron to compensate for diversions such as that through the Chicago sanitary canal has long been under discussion. There are two general methods: first, works in the outlet river, wholly in the form of fixed weirs and contractions; second, damming the river and providing sluice gates. The former are known as compensating works; the latter as regulating works. An example of the latter is at the outlet of Lake Superior at St. Mary's Falls on the St. Mary's River.

Compensating works preferable

There is a definite difference in the results obtained from these two types of works. Compensating works raise both the high and low lake levels to substantially the same extent and, after a reasonable period, the outflow from the lake will be practically the same as if the compensating works had not been built. In the case of regulating works the discharge from the lake and the resulting lake levels can be controlled within certain limits. However, regulating works are not satisfactory in controlling the levels of Lake Michigan and Huron because during low-water periods the St. Lawrence River depends, in the main, on the discharge from these two lakes to maintain navigable stages in Montreal harbor and below to tidewater.

To regulate, or cut off, the outflow from Lakes Michigan and Huron during low-water periods would result in extremely low stages in the St. Lawrence River at and below Montreal. During certain periods when, for as long as two months, there has been very little rainfall in the Great Lakes basin, practically all the water flowing from the lakes to the St. Lawrence comes from recession of the lake levels. On the other hand, to hold back considerable amounts of water during periods of excess supply in order to provide against a future period of low-supply would result in lake levels so high as to cause considerable damage to industries and homes along the shores. Regulation of Lake Superior has proved successful because fluctuations in its outflow are absorbed in the great reservoir of Lakes Michigan and Huron and are not directly transmitted to the St. Clair River and waters below. Any real improvement in lake levels of Michigan and Huron by regulation would require an expenditure greatly in excess of the estimated saving in future channel and harbor dredging, and would be at the expense of prolonging periods of low flow in the St. Lawrence.

It is advisable to restore the levels of Lakes Michigan and Huron at least by an amount equivalent to the lowering caused by diversions and channel enlargements. Compensating works offer the best means of effecting this raising of levels in the case of these two lakes.

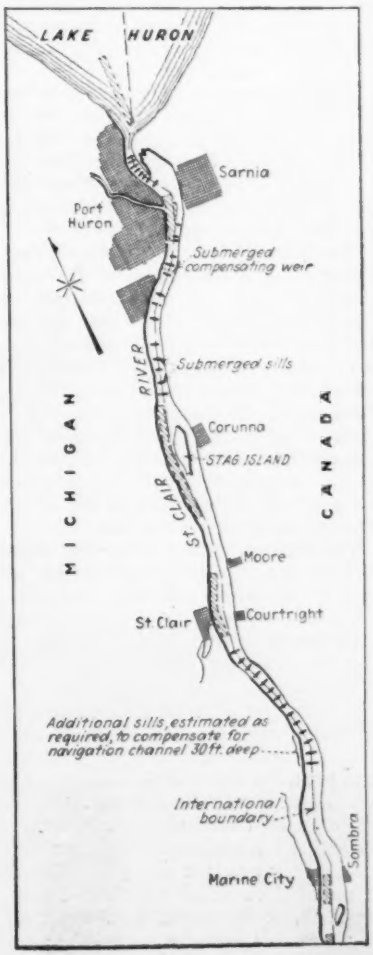


FIG. 1—PROPOSED submerged-sill compensating works in St. Clair River, as originally planned to raise levels in Lakes Michigan and Huron.

Diversions affecting levels

The withdrawal of water from Lake Michigan through the Chicago sanitary canal lowers the levels of all the Great Lakes except Lake Superior and reduces the stage of the connecting rivers below the foot of the rapids at Sault Ste. Marie as far as tidewater in the St. Lawrence. The Supreme Court of the United States in a decree dated April 21, 1930, ordered that the diversion by the Sanitary District be reduced so that after Dec. 31, 1938, it should not exceed 1,500 cu. ft. per second, exclusive of the diversion required for domestic sewage, which, it is estimated, will be 1,700 c.f.s. in 1939. This total diversion of 3,200 c.f.s. has the effect of reducing the normal levels of Lakes Michigan and Huron by 0.22 ft. Authorized diversions from Lake Erie via the Welland Canal and via the Black Rock Canal at Buffalo, together with necessary dredging and channel enlargement in the St. Clair River, have the effect of increasing this lowering to 0.73 ft.

It is computed that the compensating works projected for the Niagara River will have a backwater effect of 0.18 ft. in the Michigan-Huron Reservoir. There thus remains a net compensation of 0.55 ft. to be effected by the proposed compensating works in the St. Clair River in order to restore the levels to the stages that would exist, provided there were no diversions or enlargements of connecting channels.

Regulation studies

A study by the joint board of engineers on the St. Lawrence waterway project in 1926 was made with the assumption that the levels of Lakes Michigan and Huron would have to be raised 1 ft. The board recommended the construction of compensating works and reported that 31 sills with crests 30 ft. below low-water datum would probably be necessary. Limitation on height of these sills is necessary since navigation will pass directly over them. The figure of 30 ft. was selected so that, in case the St. Lawrence seaway project, which would call for 27-ft. depths, was later adopted, no change in elevation of the sills would be required. The sills were to be of loose rock, with top widths of 50 ft. and side slopes of 1 on 3. Eight of these sills were to be located below the gorge at the head of the river, but above the mouth of Black River; and the remaining 23 were to distributed along the river from Port Huron to Marine City, as shown on the accompanying sketch.

The U. S. Lake Survey at Detroit made further studies in 1933, additional information and data on the ultimate extent of diversions having become available in the interim. These studies and a series of experiments made in a

FIG. 2—SUBMERGED-SILL locations as indicated by model tests.

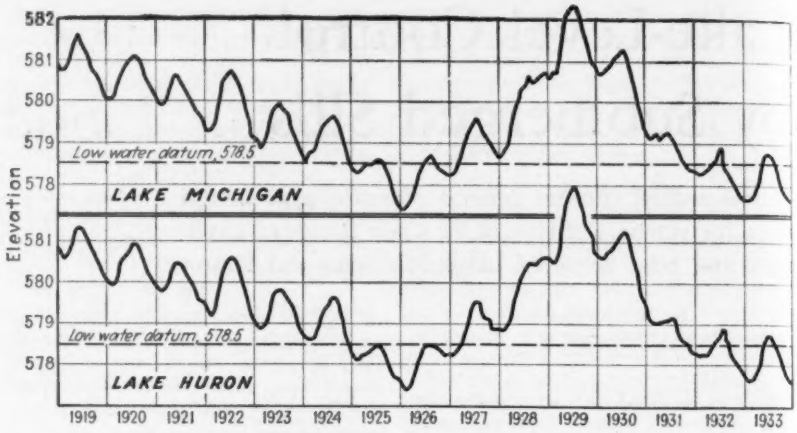


FIG. 3—MONTHLY MEAN LEVELS of Lakes Michigan and Huron for the period 1919 to 1933

small flume in the hydraulic laboratory at the University of Michigan developed the fact that the best form of sill was one with vertical faces and that the required compensation could probably be secured with six such sills, if located in the section of the river above the mouth of Black River.

Due to the relatively inadequate facilities for the experiments at the University of Michigan, the division engineer of the Great Lakes division had the problem turned over to the Waterways Experiment Station operated by the Corps of Engineers at Vicksburg, Miss. Here an outdoor, undistorted model of a section of more than 2 miles of the St. Clair River, from its head in Lake Huron to a point 1,500 ft. below the mouth of Black River, was constructed on a 1/100 scale. A series of tests with different types of sills resulted in confirming the conclusions reached by the U. S. Lake Survey. Velocity distribution became more uniform throughout the cross-section after sills were in place, and the pronounced eddy on the Canadian side opposite Port Huron was materially reduced. It was found that the type of upstream face of the sill was the important factor in the efficiency of the sill, the type of downstream face having but little effect. It was not determined how much material could be deposited above the sills without affecting their efficiency, but the loss of effectiveness would be 60 per cent should the fill reach the top of the sill. Fortunately the upper St. Clair River carries very little material in suspension, and it is thought that dredging at infrequent intervals will maintain the efficiency of the sills.

It appears that the flow over deeply submerged sills is not similar to that over the usual dam or broad-crested weir, but that the backwater effect is more a function of the turbulence produced by the submerged obstruction. In such cases study on a large-scale model is invaluable.

Backwater effects

In computing backwater effects in 1926 the joint board assumed that the fall over each sill would be equivalent to one-half the difference in velocity head above and below the sill. It was considered probable that one-half of the energy necessary to pass the water over the obstruction would be recovered below. However, experiments on the model showed conclusively that the backwater effect of the type of sill proposed by the board was only about 25 per cent of the computed effect.

To hold velocities down, so that navigation would not be hampered, the cross-sectional area of the channel at low-water datum is to be reduced to not less than 40,000 sq.ft. The mean flow at low-water datum is 194,000 c.f.s. The natural velocities corresponding to those obtained on the model with the sills in place varied from 4 to 5.8 ft. per second. For the channel without sills the velocities were unevenly distributed, but with the sills within the limits of 350 to 700 ft. came much more uniform.

The total backwater effect was found to vary directly with the number of sills, as was to be expected. However, it was found that the effect per sill was not changed by varying the spacing of the sills within the limits of 350 to 700 ft. in nature.

Comparative costs of sills constructed of steel sheetpiling and of those constructed with rock are being prepared. If of rock, the sills will probably be constructed of quarried stone of 30 to 40 tons each with vertical upstream face.

Although these studies indicate that probably six or eight sills (Fig. 2) will be required to effect the desired compensation, it is proposed to construct only two sills initially. The effectiveness of these two sills in nature will be investigated thoroughly before additional sills are installed. Consent of the Canadian government will be necessary before commencing construction, as part of the sills will be located in Canada.

Economics and cost

This solution of the problem of raising the levels of Lakes Michigan and Huron has the effect of increasing high water to practically the same extent as it increases low-water stages but, as far as can be foreseen now, this will have no damaging effects due to the tendency of the lakes to seek lower levels.

The average annual benefit to navigation on the lakes from the compensating works, due to ability to load to greater drafts, varies somewhat depending on the stage of the lakes. It has been estimated that a decrease in available draft from 24 to 23.3 ft., upon completion of the 24-ft. project for the downbound connecting channels of the Great Lakes, would result in an increased net cost of vessel operation of at least $600,000 per annum in a year equivalent to the average of the 1922-'29 period. Using this estimate in determining the economic value of installing the compensating works, it is believed that, during periods when levels of the lakes would ordinarily be 1 ft. or more below low-water datum, the proposed compensation of 0.73 ft. in Lakes Michigan and Huron and of 0.72 ft. in Lake Erie will result in a benefit to navigation of $600,000 per annum, which presumably will be returned to the public in the form of lower prices for steel and iron products, etc. As stated above, this estimate presumes return of a business year equivalent to the average of the 1922-'29 period. For the period 1924-'33, Lakes Michigan and Huron have been below the old low-water datum of 579.6 ft. above mean sea level for 70 per cent of the time. The present low-water datum at 578.5 ft. was adopted in 1933.

It is probable that the total cost of the compensating works in the St. Clair and Niagara Rivers will not exceed $1,200,000. It would therefore require only two seasons of low water to return the full cost of the compensating works in increased benefits to commerce.

Debris Flow from Canyons in Los Angeles County Flood

Character of detritus outflow which caused most of damage in January flood—Denuding of Canyon sides by fire provided areas for heavy erosion

FOLLOWING the studies of the engineers of the Los Angeles County Flood Control District, reported in *Engineering News-Record*, Jan. 11, 1934, p. 54, the specific study made by the Bureau of Agricultural Engineering (S. H. McCrory, chief), of the sources, characteristics and flow of detritus from the foothill canyons has particular interest. The following article is condensed from the report to the division of irrigation (W. W. McLaughlin, chief) by Colin A. Taylor, assistant irrigation engineer. —EDITOR.

A THIRTY-HOUR sustained rainfall of moderate intensity, ending Jan. 1, 1934, caused a considerable amount of damage in the valley and foothill areas of southern California. The most severe damage was not widespread, and the main rivers did not show abnormally high flood stages. There were, however, mud flows in the foothill areas, and sections of the towns of La Crescenta and Montrose were severely damaged by moving masses of detritus that debouched from several canyons located in the foothills to the northeast.

The loss of life and the property damage from these mud flows were unprecedented in southern California, and the opportunity is presented to draw several object lessons and to take steps to guard against a recurrence of such disastrous losses.

Storm conditions

According to Floyd D. Young, government meteorologist stationed at Pomona, Calif., this storm was peculiar and different from the usual orographic rain storms that show marked increases in precipitation with altitude as the storm winds rise over the mountains. Runoff from the higher mountains did not reach abnormally high stages, but excessive runoff did occur in the valley and foothill areas.

During the 30 hours of continuous precipitation from 3 p.m., Dec. 30 to 7 a.m., Jan. 1, between 9 and 17 in. of rain was recorded in the gages located along the foothills and in the mountains of the area. A very large number of rain gages are in operation in southern California, and the detail of the storm was very well defined. Intensity gages, of which there were several, did not show abnormally high rates of precipitation.

An examination of the rainfall records shows two periods during which the intensity was relatively higher than at other times. General runoff from the first peak was observed in the valley areas in the early afternoon of Dec. 31, but after midnight the intensity increased and remained moderately high until about 4 a.m. It was during this latter period that the damage occurred.

Damages from mud flows

The outlines of the damaged areas in La Crescenta and Montrose are shown in Fig. 1. The entire watershed above these two towns was burned over in November, 1933, and the slopes were practically barren of vegetation when the flood occurred. Shortly after midnight of Dec. 31 large quantities of debris began moving out of the canyons, and the ordinary flood channels were soon clogged with detritus so that they overflowed and spread out over fan-shaped areas. Huge boulders were carried along in the mud flows and crashed through buildings in their path, leaving gaping holes entirely through some houses and completely demolishing others.

A part of the burned-over slopes in Pickens Canyon is shown in Fig. 4. The light-colored patches are areas from which masses of soil and rock slipped down the slopes into the canyon bottom. These masses of material were so saturated with water that they were unstable and could not remain on the steep slopes, and as the masses fell into the canyon bottom the material was moved on down the canyon by the flowing water. The larger masses undoubtedly formed temporary dams across the canyon bottom, and as they gave way rushed down the canyon as a tumbling mass of boulders, soil, water and floating debris. These grinding, churning masses tore at the canyon bottom fill and battered down and swept away trees standing in the canyon. The continued downpour of rain kept these mud flows surging out of the canyon and spreading outward and downward over the fan in new paths as the channels clogged.

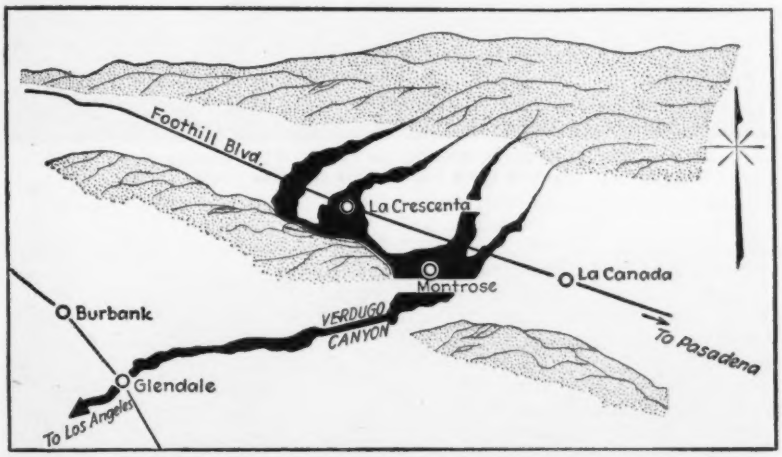


FIG. 1—LOCATION of flooded areas and natural course of floodwaters to Los Angeles River.

FIG. 2—OUTWASH from Dunsmere Canyon just above Foothill Boulevard (Fig. 1) showing boulders moved by flood.

After the peak intensity passed there was rain until 9 a.m., and the continued, though lessened, runoff cut new channels through the debris deposits.

Haines Canyon barrier

The November fire also swept through Haines Canyon, denuding much of the watershed. Great masses of debris were discharged from this canyon during the flood. There was, however, a huge flood-control barrier across the fan at the mouth of the canyon that caught the debris. The water discharging from the debris basin behind the barrier was relieved of its rolling load, and this lower channel remained clear and carried the water on to the main drainage channels in the valley.

Haines Canyon was equipped with an extensive array of rock and wire check dams 4 to 6 ft. high, but their storage capacity proved inadequate in the face of this flood, and all were filled and many broken down or carried away. Nearly all the vegetation in the water course down in the canyon bottom was swept out, and the few remaining trees bear evidence of the power of the grinding mass that moved through the canyon. The bark on the upstream side of the trees was ground off more than 6 ft. from the base, and the exposed wood was frayed and scarred from the grinding rocks and sand. Small gravel and sand were caked on and embedded in the tree trunks at heights of 10 ft. and more. The debris basin across the fan at the mouth of this canyon is formed from a huge gravel pit that has been incorporated into a flood-control works. Check dams in the unburned sections of Haines Canyon remained intact and collected little debris, showing that the fire in November was responsible for the enormous discharges of debris that came from the denuded slopes in Earl, Pickens, Dunsmere and Haines Canyons.

Mud flow from Neusbickel Canyon

A mud flow similar to those of the La Crescenta area occurred in a small canyon north of San Dimas and affords an excellent opportunity to study the details of these flows. Fig. 5 shows the source of this material on the canyon sides.

The irrigation division of the Bureau of Agricultural Engineering maintains a rain gage one-fourth mile from the canyon, in connection with a field study on the irrigation of lemon trees. This gage recorded 5 in. of rain Dec. 12-14, 1933, and 15.23 in. in the storm of Dec. 30-Jan. 1.

The soil in Neusbickel Canyon is formed from underlying sedimentary rock and supports a dense growth of mustard that starts each winter and dies down the following summer. There are also occasional patches of brush. The canyon sides are very steep—60 deg. and more in many places. The 5-in. rain of Dec. 12-14 filled the top soil to field capacity, and the fresh growth of mustard was less than ½ in. high at the start of the storm on Dec. 30. The continued rain so saturated the top soil that it slipped down the slopes at many points, forming great arrow-shaped scars on the hillside. In some cases the movement was slow so that the material was carried away as fast as it dropped into the stream bed. In other cases the evidence shows that great masses avalanched down and temporarily blocked the canyon. At the end of the storm, however, the stream bed was swept clean to bedrock, and the debris wes deposited in a fan-shaped mass at the mouth of the canyon.

FIG. 3—DEPTH OF DEBRIS on Honolulu Boulevard in Montrose. The 5-ft. boulder was brought several miles from Pickens Canyon.

FIG. 4—BURNED-OVER AREA in Pickens Canyon. Light areas show slips of soil and rock which formed debris flow from canyon.

FIG. 5—CHARACTERISTIC EARTH SLIPS in Neusbickel Canyon, which formed fan-shaped mud deltas at mouth.

Three Big Dam Operations Begin in the Northwest

Eye-witness review of conditions and initial construction operations at Bonneville and Grand Coulee on the Columbia River and Fort Peck on the Missouri River

WINTER has failed to halt preliminary work, and spring will accelerate construction activity on the three major river utilization projects of the federal PWA program in the Northwest. About $150,000,000 is involved in the present project plans for Bonneville and Grand Coulee Dams on the Columbia River and for Fort Peck Dam on the Missouri River. With 2,000 men already at work on excavation, road and building operations, plans are well advanced for calling for bids on permanent camp construction and major units of actual dam work.

At Bonneville, a short distance up the Columbia River from Portland, Ore., the U. S. engineers are beginning a $30,000,000 navigation and power development. The project will provide a 65-ft. lock lift above tidewater and will also develop ultimately 540,000 kw. of hydroelectric power (*ENR*, Nov. 9, 1933, p. 557). Several hundred miles farther upstream, where the river swings east before turning north to cross into Canada, the U. S. Bureau of Reclamation is beginning the $63,000,000 dam and power project which will ultimately be expanded into the long-planned Columbia Basin development, including the use of Grand Coulee as a secondary reservoir and irrigation of extensive areas. The present dam will raise the river level about 150 ft., providing 600,000 kw. initially.

In northeastern Montana the Fort Peck Dam project on the Missouri River is under the direction of U. S. engineers. This storage, which may total 20,000,000 acre-ft., will be used primarily for improvement of navigation on the lower river. The reservoir will permit a 30,000-sec.-ft. release during low-flow periods, and will provide incidental flood control and power development.

All three projects show evidence of the strenuous efforts of those in immediate charge to employ men at the earliest possible moment and to keep them on the payrolls. In each case work was started prior to completion of camp facilities and maintained during the winter season. This was especially true in the rigorous climate of northern Montana at the Fort Peck site. Under ordinary procedure for the planning and instituting of projects of this magnitude, the preliminary work, including detailed exploration of site and design studies, to coordinate the physical information with the most suitable design, would have consumed a period of from six months to a year before the start of actual construction. The present activity and the progress made toward the beginning of major construction operations indicates the prompt action of the federal agencies in accelerating these public-works projects. Under these conditions it is inevitable that field work has preceded the final development of design details. Final designs are now approaching completion and are being reviewed by consulting boards prior to call for bids on several major units. Subsequent descriptions will cover the details of the design and the resulting construction operations. At present, information of interest to engineers can best be presented in a brief review of conditions at the sites as they existed in the middle of March.

Bonneville

UNMINDFUL of the steady drip of the Oregon winter rain, construction activity at the Bonneville Dam project was moving forward when the site was visited. A 40-mile ride over a scenic highway up the Columbia River from Portland provides access to the site, and a railroad line along the river is available for heavy transportation. These facilities are duplicated on the Washington (north) side of the river. This double highway and railroad approach, combined with the nearness of the metropolitan center, eliminates many of the problems encountered at more remote dam locations. The general features of this federal navigation and power development (Fig. 1), being constructed under the direction of the U. S. engineers, were outlined in *ENR*, Nov. 9, 1933, p. 556.

Counterbalancing the advantage of the existing transportation facilities to the site is a problem of river control made difficult by flood peaks approaching 1,000,000 sec.-ft.; only last December severe floods broke existing records of more than half a century. The December flood interrupted the excavation work then in progress and provided stern evidence of the struggles that may occur during the coming construction seasons.

Turning off the highway, the camp is only a few hundred yards away, near the river and the navigation lock site. In a grove of tall evergreens which cannot help but bring to mind an unfair comparison to the Boulder City desert landscape, the camp buildings are now under construction. The structures will include temporary administration offices, quarters for the engineering force, twenty permanent houses, to be used subsequently by the operating force on the project, and a 400-man camp for the contractors. The usual procedure of requiring contractors to provide their own camp facilities was modified, for the dual purpose of providing more immediate jobs and of expediting the preliminary work necessary for the main contractor to begin his operations. Elaborate town facilities will not be required because of the convenient location of the project.

In addition to this camp construction, which is being done by day labor, three contracts have been let: (1) a minor contract involving about ½ mile of temporary railroad relocation; (2) a major contract for excavation of the power house and lock site; and (3) an earlier contract for excavation of the upstream end of the site, where work was interrupted by the December flood.

The present temporary railroad relocation contract on the Oregon side of the river is to permit immediate excavation for the lock structure. About ½ mile of line change and one rock cut are involved in the present work, which represents a cost of $40,000. In the meantime, extensive surveys are under way to determine the route of the ultimate 5 miles of railroad relocation necessary to raise this line of the Union Pacific System out of the reservoir site. The work will require heavy rock cuts along the sheer canyon wall and two tunnels, one of which may be more than 2 miles long. The new location is complicated by a condition of sliding ground at one point, which has for years troubled the railroad and the highway along the toe of the canyon wall near the river because of a continued slow movement. This condition has finally been relieved by drain tunnels into the slide. Final relocation will either have to cross the slide material or tunnel under it. At present, extensive drill explorations are under way to meet this problem. About $4,000,000 has been set aside tentatively for this relocation work.

The road on the Oregon side of the river, part of the famous Columbia River Highway, will not be affected by the project. On the Washington side of the river the railroad work is relatively unimportant and will only require raising the present line about 10 ft. vertically and shifting it slightly, without extensive excavation. The highway on the

north side of the river is above the reservoir flood line.

The power house and lock site are located in the smaller (south) channel, and the necessary excavation for these units, including cofferdams, is provided for by a $1,100,000 contract now starting. Exploratory work carried on subsequent to the initial layout resulted in moving the power house and lock about 300 ft. upstream from their first projected location, to place them on excellent basalt foundation. The move resulted in a saving of from 40 to 60 ft. in foundation depth. To make the best use of this relatively narrow band of basalt in the cemented tuff and volcanic conglomerate formation at the site, the lock design has been changed to a single lift of about 65 ft. This structure will all rest on the basalt as compared to a two-lift design that would have extended the foundation on to the other geologic formation.

The present contract for the preparation of these foundations requires the prior construction of two cofferdams, to unwater the section of the channel, temporarily turning all of the river into the main (north) channel. Work on these two gravel-and-earthfill embankments will be rushed, as the contract allows only 65 calendar days for their completion. This requirement is based on the need for completing cofferdam work before the usual summer flood season. They are designed to make the power house and lock site available for year-round construction.

The fill in the two cofferdams totals about 150,000 cu.yd., including rock and selected material for the upstream faces. Material will be moved by truck from the excavation area and from nearby borrowpits. Equipment is already at work on cofferdam construction. The excavation operations made possible by the cofferdamming of the channel include 575,000 cu.yd. at the power-house site and 180,000 cu.yd. for the lock. This work will be carried on concurrently with the cofferdam construction and will be completed when the channel is available.

The first major contract for the project was let last fall as a rush measure to put men to work as soon as possible. It was based on the original design layout made from available exploration data. The work included cofferdams and excavation for a section of Ambursen-type dam along the island in the river. The unprecedented floods in December raised the water level higher than could be held by the partly completed cofferdams, and the work had to be temporarily abandoned. The high water continued, and in the meantime extensive exploration work had been carried on over the entire site, and it is probable that moving this spillway section about 3,000 ft. downstream, opposite the center of the island, will prove economical (Fig. 1). This contract has not been active since it was stopped by the December floods.

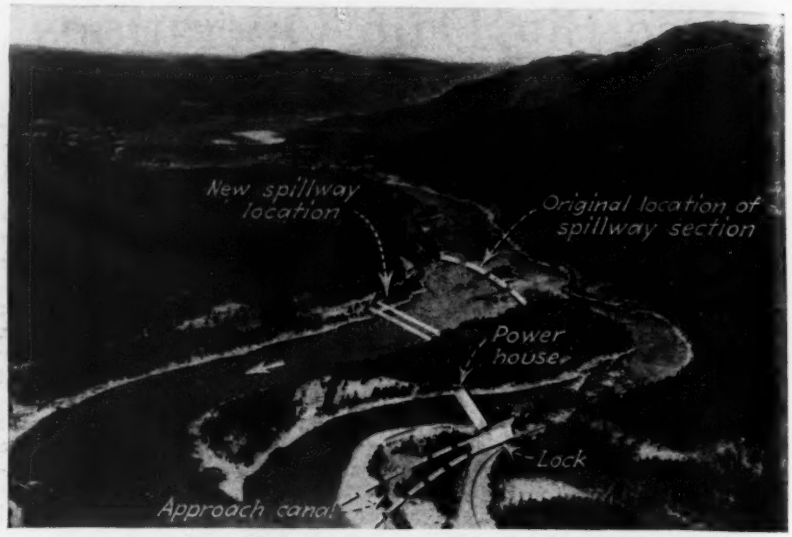


FIG. 1—BONNEVILLE DAM SITE on the Columbia River, looking upstream, with the principal features of the power and navigation development sketched in. The power house and lock are in the Oregon channel, with the construction camp site adjacent. At the far end of the island the dotted line indicates the original location of the spillway section, which has now been shifted to the location opposite the center of the island, shown in solid lines.

The Bonneville project is under the direction of Major Chas. F. Williams, Corps of Engineers, under Lt.-Col. Thomas M. Robbins, division engineer, Pacific Division, San Francisco. Lt. J. S. Gorlinski is in immediate charge of administrative affairs.

The original excavation contract at the upstream end of the site is held by the General Construction Co., Seattle, on a bid of $668,500. Contract for power house and lock excavation was awarded Guy F. Atkinson, San Francisco, for $1,173,390.

Grand Coulee

BOOM TOWNS of new, unpainted lumber border the last few miles of highway approach to the Grand Coulee Dam site on the Columbia River from Almira, Wash., temporary headquarters of the Bureau of Reclamation. The grade descends more than 1,000 ft. from the level of the country on the south side of the canyon to the river level at about El. 950. Outside the actual dam site most of the land is privately owned, which precluded the establishment of a government reservation similar to the Boulder project plan and the area (Fig. 2) has an atmosphere resembling a mining camp of a past generation. The purchase of these adjacent lands would only result in forcing the towns back a short distance, and, as a result, the policy will be to control conditions rather than to attempt to eliminate them.

The present project will provide a straight-section concrete gravity dam, to raise the river level about 150 ft., and a hydro-electric power plant. The program is designed to permit subsequent expansion into the ultimate development, which will include a 450-ft. dam with a 1,575,000-kw. power-plant installation and a pumping plant to lift irrigation water from the reservoir into the Grand Coulee, which will be dammed at both ends to provide secondary storage for 2,000,000 acres of irrigation development. The plans for the final project, as presented in a report prepared by the Bureau of Reclamation, were outlined in *ENR*, June 30, 1932, p. 907.

At the dam site, present activity centers on the excavation of overburden (Fig. 3) in the abutment areas, together with the completion of core drilling and test-pit sinking. The preliminary excavation contract, involving 2,000,000 cu.yd. of earth, divided about equally between the two sides of the river, is only a small part of the 13,000,000 cu.yd. of excavation required for the building of the dam. The contract was let in advance, to put men to work, and will assist the start of the main contract, to be let in the late spring, or early summer, according to present plans.

Power-shovel scrapers and a fleet of trucks are the major equipment units handling the common excavation at the rate of about 1,000 cu.yd. per hour. This contract is now more than half completed. Material is hauled about ½ mile and wasted upstream in the reservoir site.

The excellent granite rock of the location has been cut down by the river, with canyon walls about 4,000 ft. apart,

FIG. 2—LOOKING DOWN into the Columbia River Canyon from the present approach highway with the river and the Grand Coulee dam site at the extreme right. The typical boom towns incidental to the start of the project can be seen scattered over a wide area on the left.

and extends under the stream with an almost floor-like surface. There is a 50 to 60-ft. depth of river deposit in the channel. Condition of the granite at the site is so sound that innumerable 8-ft. cores (capacity of the drill) have been removed during the foundation exploration.

About 6 miles above the dam site on the south bank of the river, extensive gravel deposits are being explored and tested as the source for aggregate. The development and handling of this material will be a problem for the contractor and would normally involve either railroad or aerial-tram transportation.

The south bank of the river at the site is now occupied by a nondescript collection of temporary buildings for the present contractors' forces, but these structures will be removed later when the permanent camps are established. Slightly more than ½ mile below the dam site is the location for the government camp and for the permanent buildings of the operating force. An ample area sloping gradually toward the river is already laid out for this development. The site will contain all of the administration buildings and houses for the engineering forces, as well as a few lots for such commercial concessions as may be considered necessary. There will be no special effort made toward the establishment of a permanent town, such as was done at Boulder City, and the intent will be to provide an adequate, modern construction camp, with such permanent buildings as will be required for the needs of the power-plant operating force.

A contract will be let soon for street grading, followed by the installation of the water supply and sewer systems. It is planned that the camp will be ready for occupancy and that headquarters can be moved to this location during the summer. Domestic water will be supplied by a large spring that is being developed in the side canyon behind the camp site. A second system of raw water pumped from the river to tanks above the town will supply the needs for sprinkling lawns and fire protection. The sewerage system will provide for discharge into the river without treatment, since the volume of water will provide ample dilution.

The main street of the camp site will lead to the approach of a bridge to be built across the river. At present, two ferries provide the only means of crossing. The bridge will be a cantilever structure with a 550-ft. center span and 200-ft. anchor arms. Designs for this structure were prepared by the state highway bridge office, and construction will be carried out by the bureau. Bids have already been called for the substructure, and a subsequent contract will be awarded for providing and erecting the superstructure. This highway bridge will provide the main river crossing during the construction period, and for the intervening years until the dam is completed to its ultimate height, when a highway crossing on the crest will be provided.

On the north side of the bridge there is a flat area of ample size that will be available for the camp site and shops of the contractor. This area will be developed by the contractor, including such facilities as may be necessary. Beyond the contractor's camp site is a flat area that has been prepared as an airplane landing field.

Prosecution of the main contract, naturally, will depend upon the program laid out by the contractor. Work will include about 11,000,000 cu.yd. of earth and rock excavation to prepare the site, the construction of a dam about 4,000 ft. long and about 200 ft. high. The structure will be a concrete dam, straight in plan, and will have the power-plant structure incorporated with it on the

FIG. 3—GRAND COULEE DAM SITE from the west abutment, showing abutment stripping in the foreground and a light scar area on the far bank, about 4,000 ft. away, where similar stripping is in progress.

downstream side. Diversion operations will consist of turning the river to one side of the canyon for the construction of half the dam and then diverting it back through openings left in the dam, for construction of the other half.

Transportation facilities to the site are unsettled. The plan of the bureau to permit the railroad to build a 30-mile line up Grand Coulee from the town of Coulee on an existing line of the Northern Pacific was complicated by the request of the railroad to have exclusive rights for transportation of the bulk of the material to be moved. This request of the railroad was denied by the state public utility commission in favor of allowing truck competition. This action resulted in the railroad's decision not to construct the branch line, and the final solution is awaiting the decision of the bureau, which may be predicated on the plans of the contractor.

There is also a 30-mile transmission line to be built up Grand Coulee from the existing power system. Present plans may leave the building of this power line and the negotiations for power up to the contractor. The state is improving the present highway approach to the site from the south through Grand Coulee, and this will become the major transportation highway because of the easy grade. These transportation and power-line facilities in Grand Coulee occupy the reservoir site of the ultimate development, and will ultimately be drowned out.

Because of the isolated location, labor will be allowed to work a 40-hr. week under existing PWA requirements. The present contractor is using a schedule consisting of three 6-hr. 40-min. shifts daily for a six-day week.

F. A. Banks is construction engineer for the Bureau of Reclamation in charge of the project, reporting to the engineering headquarters of the bureau at Denver. The present contract for the 2,000,000 yd. of overburden excavation was let to D. H. Ryan, San Diego, Calif., at a bid figure of $534,000.

Fort Peck

THROUGH the rigors of a Montana winter the preliminary work on the Fort Peck Dam project has been rushed by the U. S. engineers, to provide maximum possible employment as a relief measure and at the same time to advance the start of active work on the dam proper. The project will provide a reservoir on the Missouri River in northeastern Montana, with a capacity of about 20,000,000 acre-ft. The structure will be of hydraulic-fill type, involving an unprecedented quantity of material approaching 75,000,000 cu.yd. The purpose of the reservoir is to regulate the flow of the Missouri River to a 30,000-sec.ft. minimum as a navigation improvement for the lower river, with a secondary feature of flood control and incidental hydro-electric power development. Design details have not been completed, but the physical aspects of the site (Fig. 4) and the preliminary work now under way can be described.

Glasgow, Mont., the temporary headquarters for the project prior to the establishment of a construction camp at the site, is experiencing the usual boom activity and has an exciting scarcity of hotel facilities. The through train on the Great Northern Railroad arrives about 2:30 a.m., and beds are often occupied for the first half by individuals who get up and take the night train, to be followed, for the rest of the night, by a new group just arrived—no reservation, no bed. The town is about 17 miles from the dam site, which is directly south on the Missouri River.

With authorization of the project Oct. 16, and a subsequent order to place as many men at work in as short a time as possible, the first work to be undertaken was the clearing of the general dam-site area. Five hundred men were put to work within two weeks, and this number was increased to 1,000 before the end of November, with this force maintained up to the present time. Strenuous efforts were required during the winter to keep the road to the dam site open for the clearing crews going to the location daily. The effectiveness of this work is evidenced from the fact that on only one day was the road closed as the result of severe snow. With the coming of spring, this struggle was continued in the face of water and mud.

An improvement and partial relocation of this route will be undertaken immediately by the Montana highway department, to provide a modern highway with plant-mix surfacing. Ultimately this route will cross the completed dam and continue south.

The construction railroad will extend on an easy grade for 12 miles to the site from Wiota, a station 20 miles east of Glasgow, on the main line of the Great Northern Railroad. The line will be constructed by the U. S. engineers. The grading has been almost completed to the site, using equipment and operators rented from contractors and local common labor. Volume of fill is light, involving about 350,000 cu.yd. for the line and terminals, and is obtained principally from borrowpits, with relatively short haul. This work has been carried forward during the winter and the spring with particular difficulty encountered in handling equipment after the ground began to soften.

About one mile from the junction with the main line, the construction railroad crosses the Milk River. The bridge consists of three 100-ft. plate-girder spans resting on timber-pile clusters protected from ice and scour by inclosing the clusters in steel sheet-piling. The bridge is being built by the Minneapolis Bridge Co. under contract, and is being rushed into early service as the key to completion of the railroad, which, in turn, is important for the opening up of the site for major construction operations. Timber-pile erection bents were driven into the river, and the floor beams and stringers were placed first, to permit track to cross, with the placing of the girders to follow. This process will allow the advance of track laying on the far side of the river, although some chance was involved in the method of construction because the ice and high water of the spring might damage the temporary piling. The procedure is typical of the efforts being made to advance the project as fast as possible. Track laying, already completed to the bridge,

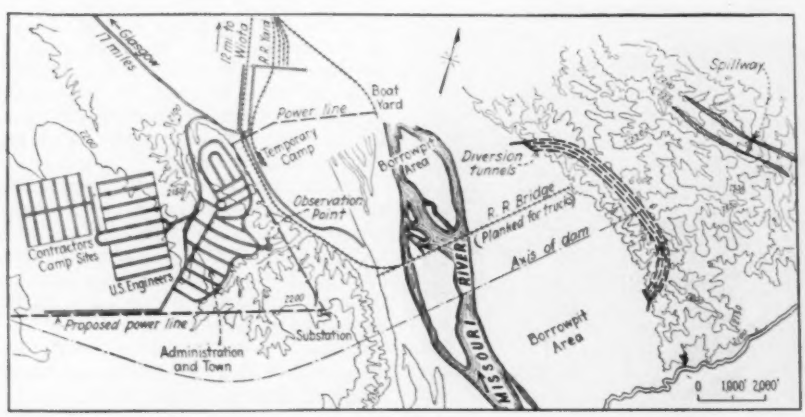


FIG. 4—FORT PECK dam-site area with the arrangement of the camp and transportation facilities to be built this spring. The position of the diversion tunnels and the axis of the dam is indicated.

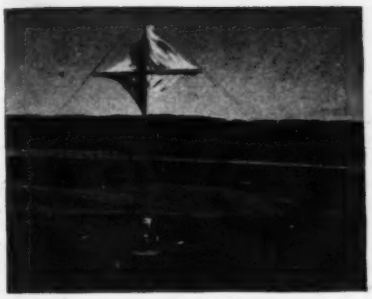


FIG. 5—LOOKING EAST across the Fort Peck Dam site about 8,500 ft. to the bluffs on the other side of the Missouri River. The hydraulic-fill dam, containing about 75,000,000 cu.yd., will store almost 20,000,000 acre-ft. in the reservoir.

will be advanced rapidly to the dam site, followed by gravel ballasting.

The only other structure of importance on this railroad line is the crossing of the Missouri River. Located at the downstream toe of the dam, this bridge will consist of a steel trestle on timber bents with one 200-ft. through-truss span across the main channel, to permit passage of the dredges. Work on this structure has been started under contract with Massman Const. Co., Kansas City ($985,000). The trestle may be used subsequently for dumping rock along the toe of the dam. The railroad bridge will provide transportation across the river to the site of the diversion tunnels on the north side. The floor of the bridge will be planked to permit trucking.

On the bluffs on the west side of the river overlooking the dam site, stakes have been set for the town and construction camp (Fig. 4). Following street grading and surfacing and installation of a water-supply and sewage system, camp buildings will be constructed. Nearest the river will be the administration building, residences for officers and for such commercial activity as is considered necessary. Back from this section of the town site there will be an area reserved for the employees of the U. S. engineers, and adjoining this will be space allocated for the contractor's camp.

The water supply will be obtained from the river. River water is comparatively clear at this point, as most of the silt usually attributed to the Missouri River comes from the Yellowstone River, which enters below the dam site. Present plans call for completion of the camp and its occupation as construction headquarters by July.

At present, there is a temporary camp for the engineering force and some buildings in use by the bridge contractor at the site.

The principal present construction activity at the site in the boat yard on the river bank, where the timber dredges, scows and pontoons for the dredge lines are being built (Fig. 6). This work involves a crew of almost 150 men, mostly skilled timber workers and calkers. The first one of the four 130x30x9-ft. timber dredge barges is nearing completion. In addition, four 100x30x6-ft. barges are being built to service each of the dredges, and 72 pontoons are under construction. The total number of pontoons will exceed 375, required to support the pipe lines between the dredges and the dam.

One of the first major contracts to be let will be for driving and lining the four 28-ft. finished diameter diversion tunnels, each about one mile long. All of these tunnels will be driven in the shale formation through the bluffs on the east side of the site. An unusually thorough investigation has been made to provide information for the use of contractors in preparing bids. In addition to the usual drilling, a test tunnel was driven 200 ft. into the bluff at right angles to the tunnel line to prove the character of the shale and indicate the probable cost and the best driving methods. During the driving of this test tunnel, various types of drills, different spacing of holes and varieties of explosive were tried and the data carefully recorded. At the end, a section was widened out to full-tunnel semi-section to determine ability of the material to stand and the susceptibility to weathering. Various types of protective coatings were tried on the shale formation, including sprayed cement mortar and different types of asphaltic preparations.

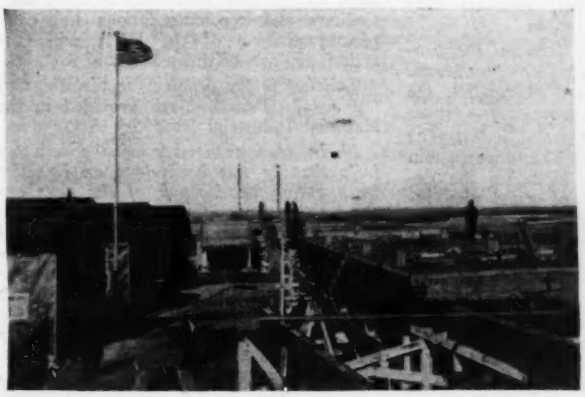
All of this information has been prepared and has been made available for all bidders in the form of an appendix to the specifications. As mentioned, the railroad will be laid to the tunnel site, and power will be sold to the contractor from the government line at cost plus a proportionate share of the transmission line cost. The estimated period for driving and lining the tunnels is eighteen months. Following the construction period, the tunnels will be provided with a steel lining and a concrete interlining. Bids on the tunnel work are scheduled to be opened on April 11.

Work on the main dam will not be delayed waiting for the tunnels to be completed. The present plan is to begin filling as soon as practicable on the low flat area on either side of the stream channel, after the removal of the silt overburden. These hydraulic-fill operations can be continued for two years along the two sides of the river valley without necessitating the diversion of the stream. At the end of this time the tunnels will be completed and the river will be diverted. The dredges will operate in the river channel and in self-excavated borrowpits to be located in the wide area both above and below the actual dam site.

The spillway is to be located through a natural saddle on the east side of the site, removed from the dam, and the discharge will return to the river through a channel that will involve land of only minor value. Present plans call for competion of the entire project by 1939.

The project is being constructed under the direct supervision of Major T. B. Larkin, district engineer, with headquarters on the job. The creation of this district resulted from the concentration of activity at the Fort Peck project. Major Clark Kittrell is construction engineer. Plans for the project are being worked out in the division office at Kansas City.

FIG. 6—BOAT-BUILDING YARD, where the hulls for four large dredges and other barges are under construction (left) as well as dozens of pontoons for supporting the dredge lines (right).



How the Code Affects the Contractor

A Digest and a Catechism

WHAT is the construction code and how will it be administered? What is the meaning of its various provisions? How will it govern the conduct of the individual contractor? The answers to these and many other perplexing questions asked by bewildered contractors are presented in the following digest prepared by *Engineering News-Record*. In addition, answers to pertinent questions concerning the code and its operations are given. This analysis has been made by editors who have been in close touch with the various committees in the development of the code from its very beginning, but no part of this article is to be regarded as an official ruling of any code authority.

The Code As a Whole

THE construction code is a code of fair competition for the industry. It means just that—a codification of just and fair practices intended to eliminate the disruptive and ruthless conduct of business that has disorganized the whole industry. The code was prepared by the Construction League of the United States and its allied association in accordance with the National Industrial Recovery Act of 1933. *Approval by the President* on Jan. 31, 1934, upon recommendation of the NRA Administrator, *made it a law*, binding on all engaged in construction on and after its effective date, March 2, 1934.

It is under the administration of the Construction Code Authority. The code, a single document embracing all classes of construction operations, is divided into several chapters. Chapter I covers general provisions, governing the entire industry, outling general administration procedure and providing for the creation of divisional chapters. Each subsequent or divisional chapter applies specificially to the branch or division of the industry defined in that chapter, and each division will have its own divisional authority as a governing body. Each branch or division of the industry will be under the control of its own divisional chapter code and will also be governed by the provisions of Chapter I, which apply to all, except in case of conflict, in which case the provisions of Chapter I are superseded. Pending formation of divisional chapter codes, divisions will be under the control of Chapter I. Chapter II, applying to general contractors, became effective March 19.

Subdivisions of various chapter codes will be provided where needed to govern effectively subdivisions of a section or division. Under the general contractors' divisional Chapter II, subdivisions II A, II B and II C are being established for building contractors, heavy construction contractors and highway builders. Each subdivision will have its own supplemental rules adding to or modifying Chapters I and II.

The code provides for the establishment of a National Construction Planning and Adjustment Board. This board is largely occupied with labor relations.

Application and Scope

THE code is not a perfect document. During its formation it was as impossible to foresee all the questions that would result in operation of the code as it is to foresee all possible conditions in preparing a set of contract specifications. Many points in question remain to be settled by ruling of the code authorities; some weak parts of the code may be strengthened by early amendments. Code authorities have asked contractors to be patient and to cooperate fully during the working out of the perplexing questions that will arise.

1. What is the application of the code? The provisions of the code apply to the entire industry, excluding operations undertaken in accordance with bona fide bids made after Dec. 31 but before March 2, and excluding contracts entered into prior to March 2. For example, a construction operation for which bids were received Jan. 15, 1934, and contract awarded March 5, 1934, is exempt from the provisions of the code.

2. What is the application of the divisional chapter codes? Provisions of the divisional codes apply only to the branch of the industry defined in such chapter. The rules of any chapter govern employers under that chapter only; they do not govern other employers, nor do they govern any employees.

3. In case of conflict between the general provisions and chapter provisions, which governs? In case of conflict, the chapter provision shall govern.

4. What is the construction industry as defined by the code? The constructoin industry is defined as including the design and construction of (and the installing and the applying, including the assembling at the site, of manufactured products incorporated in and to): building structures, including modifications thereof and fixed construction accessory thereto, intended for use as shelter; and other fixed structures and other fixed improvements and modifications thereof, intended for use in industry, commerce, sanitation, transportation, communication, flood control, power developement, reclamation and other similar projects or services; and such related division or subdivisions thereof as may be defined in chapters of the code and included with the approval of the President. A member of the industry is any individual or organization undertaking to perfom any construction as above defined, including architects, engineers, contractors and subcontractors.

5. What is a general contractor, according to the code? Any individual, partnership, association, trust, corporation or agency which undertakes, by formal contract or otherwise, to direct, superintend, coordinate and execute either directly or through others, the work of constructing, substantially in its entirety, any fixed structural or physical improvement, or modification thereof, or addition or repair thereto, excluding any such operation aggregating in its entirety less than $1,000.

6. How is the code to be administered? By the Construction Code Authority and the several Divisional Code Authorities. The latter will have state, regional or local administrative agencies, established by the Divisional Code Authority and possessing such powers as it may delegate.

7. What is the organization of these authorities? The Construction Code Authority is composed of one member representative from each of the sponsor groups of the construction code, with the Associated General Contractors allowed four members, and three non-voting members appointed by the Administrator as his representatives. Stephen F. Voorhees is chairman; its present office is 970 Willard Hotel, Washington, D. C. The General Contractors' Divisional Code Authority is composed of seventeen members, twelve of whom were appointed by the A.G.C., the twelve appointing five non-members of the A.G.C. to complete the membership to seventeen. A. E. Horst is chairman of the Divisional Code Authority. Its office is in the Munsey Building, Washington, D. C.

8. How are the provisions of the code enforced? The several code authorities have no punitive powers, but upon their findings and recommendations the compliance division of the NRA will take action against offenders.

9. What is the penalty for violations of the code? Penalties are provided in the National Industrial Recovery Act.

10. In case a member of the industry feels that he has been done an injustice by a ruling or decision of the code authority, has he any recourse? Any complaint may be appealed to the Divisional Code Authority and have a prompt hearing. Any interested party shall have the right of appeal to the Administrator in respect to any decision or finding made by the Construction Code Authority or the Construction Appeals Board.

11. Railroad operation at present is not

subject to NRA regulation. Is a railroad subject to construction code regulations when doing its own construction work? The terms of the code clearly cover such work. No specific ruling on the question has yet been made, however.

12. Are utilities, such as power companies and telephone companies, subject to the code when doing their own construction? Answer as for 11.

13. Are private industries and private individuals subject to the code when doing construction work for their own use by the day labor system? Answer as for 11.

14. Do day-labor construction operations by states, municipalities and other public agencies come under the code? At present, codes do not apply to any governmental or quasi-governmental body.

15. What is the dividing line between maintenance and construction as regarded by the code? For example, is railroad reballasting and tie replacement to be regarded as construction or maintenance? Where maintenance operations fall under the definition of Chapter II (See answer to Question 4) "modifications thereof [of fixed structures or physical improvements] or additions, or repairs thereto" and exceed in cost $1,000 they are covered by the code.

16. Is highway maintenance work subject to the code? If done by contract, the preceding answer applies. If done by day labor, the question cannot now be answered.

17. Does the code require a contractor to be a member of a contractors' association to operate under the code? All members of the industry must operate under the code regardless of membership in associations.

Bidding Practices

DEFINITE rules regarding bidding are contained in Chapter I, and are therefore binding on all the industry. Bid shopping and bid peddling are specifically banned. Limitation of the number of bidders is recommended.

(Reverse Side of Registration Form)

INFORMATION AND INSTRUCTIONS FOR GENERAL CONTRACTORS REGARDING REGISTRATION OF CONSTRUCTION WORK OR SERVICES

Read Chapter I and II of the Code of Fair Competition for the Construction Industry and these instructions carefully, which apply to all General Contractors.

"Member of the Construction Industry" Definition from Chapter I, Article II, Section 3: "The term 'member of the industry' as used herein includes any individual or form of organization or enterprise engaged in any phase, or undertaking to perform any of the functions of the industry. . . either as an employer or on his own behalf, including also, but without limitation, architects, engineers, contractors and subcontractors."

"General Contractor" Definition from Chapter II (General Contractors' Division of the Construction Industry), Article I, Section 1: "The term 'general contractor' is hereby defined to mean without limitation any individual, partnership, association, trust, trustee, trustee in bankruptcy, receiver, corporation or agency which undertakes, whether by formal contract or otherwise, to direct, superintend, coordinate and execute, either directly or through others, the work of constructing, substantially in its entirety, any fixed structural or physical improvement, or a modification thereof, or an addition or repair thereto, excluding any such operation aggregating in its entirety less than the sum of $1,000. It is recognized that the function of the architect or professional engineer is to design or plan construction projects and, acting in his professional capacity, to supervise the execution thereof on behalf of the owner. Such architects or professional engineers in the performance of their normal and customary functions shall not be deemed to be included in the foregoing definition of a general contractor."

Reference is made to Article IV-A, Section 2(d), of the Code of Fair Competition for the Construction Industry (Chapter I) and reference is also made to Article II, Section 2(b) of the Code of Fair Competition for the General Contractors Division of the Construction Industry (Chapter II). The amount of registration fee for general contractors is on the basis of one-tenth of one per cent (1/10 of 1%) of the total amount of the work undertaken and is applicable wherever such work exceeds two thousand dollars ($2,000) in value. For example, for a $10,000 job (whether on the basis of lump-sum contract or of cost plus a service fee of any nature or of any other type of contract or agreement), the fee is $10; for a $105,500 job, the fee is $105.50; for a $1,000,000 job, the fee is $1,000.

For the proper registration of all contracts or agreements for work and/or services entered into on or after March 19, 1934, a general contractor must for each such contract or agreement fill out the application for registration on the obverse side of this form and promptly forward same in triplicate to the Divisional Code Authority for General Contractors, Munsey Building, Washington, D. C., with check or money order in the amount of one-tenth of one per cent (1/10 of 1%) of the total value of the work or services. This said fee includes payment for the registration of the construction work or services with the Construction Code Authority, in evidence of which registration the registrant will receive from the Construction Code Authority a certificate of registration, which is to be prominently displayed on the project registered.

A separate certificate of registration is required for each separate contract or agreement for construction work and/or services.

Upon the completion of each project registered, the general contractor shall forward to the Divisional Code Authority for General Contractors a statement of the net increase, if any, or decrease, if any, in the total value of the work and/or services as compared with the total value named in the original application. This statement shall be accompanied by a check or money order for additional registration fee in case of increase, or an application for rebate of the proper portion of the original registration fee in case of decrease, as compared with total value originally registered.

Form R-1 — Read Carefully Instructions on Reverse Side

Application for Registration of Construction Work or Services
with DIVISIONAL CODE AUTHORITY FOR GENERAL CONTRACTORS
MUNSEY BUILDING, WASHINGTON, D. C.
In Cooperation with the Construction Code Authority

Application is hereby made for a Certificate of Registration under the Code of Fair Competition for the Construction Industry, pursuant to Chapter I [Art. IV A Sect. 2 (d)] approved by the President January 31, 1934, and Chapter II [Article II, Section 2 (b)] approved by the President February 17, 1934.

Project _____ (Name or Type of Project) Amount Our Contract or Work Thereon _____ (If amount is not predetermined, give estimated total cost)

Location of Project _____ (Address) _____ (City) _____ (County) _____ (State)

Owner _____ (Name) _____ (Address) _____ (City) _____ (State)

Date Work Undertaken _____ (Date of Contract or Date Work Started) To Be Completed by What Date _____ (Month) _____ (Year)

Brief Description of Work to Be Done Under This Application:

Name of Party with Whom We have Contract or Agreement for Work under This Application:

_____ (Name) _____ (Address) _____ (City) _____ (State)

Indicate Whether Above Party Is ☐ Owner ☐ Architect ☐ Engineer ☐ General Contractor ☐ Special Contractor

It is agreed that any major additions, corrections or alterations to the work to be done under this application will be reported to the Divisional Code Authority for General Contractors, and that monthly or special reports will be filed as required.

Herewith is attached remittance in the sum of $_____ in payment of the registration fee for the work under this application.

NOTE: Check or money order is to be made payable to Divisional Code Authority for General Contractors. Registration Fee is one tenth (1/10) of one (1) percent of the amount of contract or work—(By order of the Divisional Code Authority for General Contractors, March 10, 1934, and effective beginning March 19, 1934.)

It is hereby certified that the above information is correct.

Name of Applicant _____ (Firm) Date _____

Address _____ (Address) _____ (City) _____ (State)

Enrollment No. _____ By _____ (Signature) _____ (Title)

This Application Is to Be Forwarded in Triplicate to the Divisional Code Authority for General Contractors, Munsey Bldg., Washington, D. C.

NOTE: On and after March 19, 1934, all construction work and services in excess of $2000.00 shall be registered by the General Contractor within 15 days after the work is undertaken and a registration fee paid thereon to the Divisional Code Authority for General Contractors. Failure to register and pay the registration fee for such construction work is a violation of the Code and the National Industrial Recovery Act. Certificate of Registration issued under this application to be prominently displayed on the work.

— — — — — — — — — — Below This Line Not to Be Filled Out by Applicant — — — — — — — — — —

Type of Work
☐ NEW CONSTRUCTION
☐ RECONSTRUCTION OR MODIFICATIONS
☐ MAINTENANCE

Class of Work

BUILDING STRUCTURES
☐ Commercial
☐ Industrial
☐ Residential
☐ Institutional
☐ Public
☐ Social and Recreational

SANITATION
☐ Waterworks
☐ Sewerage
☐ Sewage Disposal
☐ Waste Disposal
☐ _____

TRANSPORTATION
☐ Streets and Roads
☐ Bridges and Grade Separations
☐ Railways
☐ Railroads
☐ Airways
☐ Waterways
☐ Pipe Lines

☐ COMMUNICATION
☐ FLOOD CONTROL
☐ POWER DEVELOPMENT
☐ RECLAMATION
☐ LAND DRAINAGE
☐ _____
☐ _____

Subdivision _____

Forwarded by _____ Date _____

Forwarded by _____ Date _____

DIVISIONAL CODE AUTHORITY

Date Received _____

Sent to CCA Date _____

By _____ Fee Attached $ _____

CONSTRUCTION CODE AUTHORITY

Date Received _____ Reg. Cert. Sent Date _____ To _____ Reg. No. _____

18. How are bids to be submitted? In writing, signed by an authorized representative of the bidder.

19. Are alternate proposals permitted? Alternate proposals may be submitted with the original bid, providing the same privilege is extended to all bidders.

20. May a bidder revise his figure after bids are opened? No; bona fide mistakes discovered after opening of bids are the only permissible reason for withdrawing a bid. Revision of a bid is not permitted in any case.

21. Are supplemental bids allowed? Awarding authorities may request supplemental bids because of substantial changes in plans or specifications, but such bids must reflect only the true value of the changes.

22. What is the time limit in making an award after bids have been received? The awarding authority must make an award or reject all bids for the principal contract within twenty days after the stipulated time for the receiving of bids, except where an extension of time has been requested from the bidders and is consented to by at least two bidders.

23. How does this provision affect public-works awards where the award is contingent upon financial conditions or other delays common to public-works contract procedure? The code makes no exception for this case.

24. May all bids be rejected, and if so, are there any restrictions to rebidding? The right to reject any and all bids may be reserved by the awarding authority, such rejection to be made in writing. Chapter I provides that where all bids are rejected (Chapter II specifically mentions private contracts only), bids shall not again be invited or submitted for the mere purpose of obtaining a lower or revised price for substantially the same work previous to the lapse of 90 days from the date of such rejection, except when there is a substantial change in the plans or specifications, or unless there is evidence of collusion, or such a marked difference between the bids submitted and the engineer's estimate of the valuation of the work as to indicate to the awarding authority the necessity of new bids to secure fair competition.

25. How are owners and awarding authorities to be made to live up to provisions of the code in respect to bidding practices? Chapter I provides that the various divisions and subdivisions may stipulate specifically in the chapters and subchapters that members shall not submit a competitive bid to an owner or awarding authority unless such owner or authority agrees to comply with the regulations provided in the code governing an awarding authority. However, Chapter II contains no such provision.

26. Is there any provision made for checking bids to force compliance with the code's regulations? Divisional code authorities shall provide, if no such provision is made in the divisional chapter, some method of checking bids either by the designation of a depository for the filing of duplicate bids or by some other method satisfactory to the Construction Code Authority.

27. Has any such provision been made for general contractors? Not yet.

28. Does the owner or awarding authority have to accept the lowest bid? No, the bid of any contractor may be accepted, providing the contract is awarded at the bidder's original figure.

29. May a contractor have an agreement with the owner prior to award of contract? No agreements are allowed prior to award of contract in competitive bidding in which the bidder or bidders agree to accept a lesser amount for services than that named in the original bid.

30. Are bids to be kept confidential until the stipulated time of opening? Yes; the awarding authority is not permitted to disclose to any bidder information relative to the price or terms of any other bid in order to influence the price or terms of such bidder.

31. How is bid shopping on the part of the owner or awarding authority to be stopped? The code governs only members of the industry. The contractor may not revise his original bid price.

32. How is bid peddling on the part of general contractors to be stopped? The general prohibition of bid peddling and bid shopping in Chapter I, together with the specific provisions of the subcontractor chapters, control both general contractor and subcontractor.

33. Are bidders permitted to get together and determine prices to be submitted or to parcel out jobs? Collusion between bidders or between awarding authorities and bidders is prohibited.

Contract Regulations

THE following bases of contractual agreements are recognized as fair practices: guaranteed price, cost of work plus a fee, unit price, lump sum and other contractual methods not inimical to the public interest, providing that code regulations are met.

Registration of contracts under Chapter II is provided for, beginning March 19, and fees are to be collected from general contractors to meet the cost of administering the code, the amount of fee dependent upon the size of contract. Each chapter is to cooperate with the Construction Code Authority on fee collection and registration.

34. How should a contract be registered? Contracts shall be registered with the Divisional Code Authority on forms and according to regulations set up by that body. Until such time as local or state agencies are established, branches and chapters of the A.G.C. will act as registration agencies.

35. Does the contractor or the owner attend to the registration of contracts? The contractor registers the contract.

36. When is a contract to be registered? Within 15 days after work is undertaken, by order of the Divisional Code Authority for General Contractors.

37. Do contracts in force prior to March 19, 1934, have to be registered? No.

38. What information must be given when registering a contract? See the registration form reproduced on p. 447.

39. How is cost-plus work to be registered? In the same manner and by the same form.

40. How is owner-operated construction to be registered? In the same manner and by the same form. The owner in this case becomes the general contractor for the work.

41. What is the amount of the fee to be paid? The registration fee of general contractors is one-tenth of one per cent of the amount of the contract or value of work to be done.

42. When is this fee payable? At time of registration; the fee must accompany the registration form.

43. How is the fee to be determined on cost-plus work? By contractor's estimate of cost; subject to adjustment as the work progresses.

44. Who pays the fee, the contractor or owner? The contractor.

45. Is a fee required for owner-operated construction work? Yes.

46. How is the amount of such a fee to be determined? By estimate, subject to adjustment as the work progresses.

47. Is public force-account work to be registered? There is no exception in the code; means of enforcement as yet uncertain. (See also answer 14.)

48. Is a fee to be paid for such work, and if so, how is the amount to be determined? (See No. 47.)

49. The usual contract includes the cost of materials in the bid prices. But in the case of the owner furnishing materials, such as cement on certain state highway work, how is the cost of materials to be figured in the registration of that contract? This point remains to be decided by the Divisional Code Authority.

50. Is a fee to be paid on the value of materials or equipment furnished by the owner, and if so, who pays it, the owner or contractor? This point remains to be decided.

51. In construction operations, are existing state, municipal and federal laws superseded by provisions of the code? No provision of the code shall supersede any state, municipal or federal law imposing more stringent requirements regarding any working conditions. (See also No. 70.)

52. How are general contractors to be qualified? They are to be qualified by capital, organization and experience. A contractor is expected to own or to have available sufficient and proper equipment to execute the work or to furnish evidence of his ability to acquire same.

53. Is a contractor required to reveal his financial position? A general contractor shall make available upon request of those responsible for the awarding of contracts pertinent information as to his current financial position, using the standard questionnaire forms developed and approved by and available through the Joint Conference on Construction Practices, Washington, D. C., or other forms approved by the Administrator.

54. May a contractor demand proof of financial reliability from the owner? The contractor may request financial information from the owner equivalent to that required of the contractor.

Subcontracting Relationships

THE code in general stipulates the same treatment of subcontractors by general contractors as is demanded of

owners in relation to general contractors. Bid peddling and bid shopping are prohibited. Most of the subtrades will have their own divisional chapter codes, which will further govern the conduct of subcontractors and their relations with general contractors.

55. Are general contractors required to name their subcontractors? Before making an award, an awarding authority may require a general contractor to name the subcontractors whom he intends to employ for the various divisions of the work.

56. May a general contractor accept a lower bid from a subcontractor than that originally supplied, after the general contract is awarded? All sub-bids must be in 24 hours before opening of bids (according to provisions of Chapter I). All later sub-bids are to be returned unopened. This evidently makes unlawful the receiving of new sub-bids after the award. Where no sub-bid has been taken in advance, the general contractor may later decide to subcontract, and may ask sub-bids for this purpose.

57. If a general contractor calls for sub-bids on certain work, is he bound to accept one of the bids offered by a subcontractor, or may the general contractor elect to do the work himself? He may elect to do the work himself, if he has reserved the right to reject all bids.

58. May a general contractor call for sub-bids on certain work after he has been awarded the general contract? If so, is he restricted by the same regulations regarding bid shopping and peddling that apply to sub-bids taken prior to the award of the general contract? Yes.

59. Is the general contractor permitted to reject all sub-bids and, after the award of the general contract, call for new bids? Not if he used them in making up his bid nor without waiting 90 days. (See also answer to question 24.)

60. May a general contractor accept from or give to subcontractors any rebates, refunds or allowances? A general contractor shall not give or accept rebates, refunds, allowances, unearned discounts or special services to or from subcontractors, material venders or others which are not extended to all of equal credit rating.

61. May a general contractor waive certain legal rights? A general contractor shall promptly inform subcontractors with whom he is contracting of any waiver of lien rights executed by him.

Labor Relations

SPECIAL attention to labor relations is given in Chap. I, supplemented by a few provisions in Chap. II. Definite figures are set for maximum hours of work and minimum common wages.

In each division and subdivision of the industry, truly representative associations or groups of employers and employees respectively concerned, after proper notice and hearing and as a result of bona fide collective bargaining, may establish by mutual agreement (when approved by the President as provided in Section 7b of the National Industrial Recovery Act) for a specially defined region or locality the standards of hours of labor, rates of pay and such other conditions of employment as may be necessary to effectuate the policy of Title I of the Act.

62. What are the minimum rates of pay named in the code? The minimum rates of pay named in Chapter I, and therefore binding on the whole industry, applicable in the absence of mutual agreement as otherwise provided, are: for common labor only, excluding accounting, office and clerical employees, 40c. per hour; office and clerical employees, $15 per week in cities of more than 500,000 population; $14.50 per week in cities of more than 250,000 and less than 500,000 population; $14 per week in cities of more than 2,500 and less than 250,000 population; and $12 per week in towns of less than 2,500 population.

63. Do these rates apply to piecework? Yes, and on any other basis of payment.

64. What are the maximum working hours stipulated? No employee shall be permitted to work in excess of 40 hr. per week or in excess of 8 hr. in any one 24-hr. period.

65. Are there any exceptions to these working hours? On application to and approval of the National Construction Planning and Adjustment Board, an employee may be permitted to work 48 hr. in any one week: (*a*) on projects so remote and inaccessible that camps are necessary for the housing of the majority of the labor employed; on such remote projects when working time has been lost because of unavoidable delays in any one week, it may be made up in the following four weeks; and (*b*) on projects in localities where a sufficient amount of qualified labor is not available in the immediate vicinity of the work. (See answers 67 and 68.)

66. Are the foregoing maximum hours of work to be regarded as a minimum? No. Working hours may be reduced by mutual agreement between employer and employee where such reduction does not work a hardship on either the employers or employees.

67. Are any employees exempt from the hours of work provisions? The following classes are exempt: those engaged in professional, executive or supervisory work; those engaged in emergency work involving breakdowns or protection of life and property; watchmen; other employees who may be exempted in chapters of the code specifically applicable only to the divisions therein defined.

68. Are office employees subject to working time provisions? Accounting, clerical and office employees may be permitted to work not in excess of 40 hours per week averaged over a period of four consecutive weeks.

69. Is there a minimum age limit for employees? The minimum age is 16, except in occupations hazardous in nature or dangerous to health, when the minimum age is 18, subject to existing state laws.

70. Are existing labor regulations affected by the code? Where code provisions of labor rates and hours of work conflict with those established for specific projects by competent governmental authority or agencies acting in accordance with law, any employer required to comply with provisions so established is relieved of compliance with conflicting provisions of the code.

71. Do existing labor agreements still hold? Provisions of labor agreements in force on the effective date of the code shall be complied with during the life of such agreements, even though they be in conflict with provisions of the code.

72. Is a contractor forced to use union labor? No.

73. May a contractor discriminate against union labor? No.

74. How are area or local labor agreements to be made? The procedure remains to be worked out.

75. Are such agreements binding on all contractors in such areas or localities? Yes, when approved by the President.

76. Are agreements made by any division or subdivision binding upon any other division or subdivision? No.

77. May a contractor accept or demand rebates from employees? A general contractor or his agents cannot accept rebates directly or indirectly from employees or give anything of value or extend favors to any person for the purpose of influencing wages or the working conditions of his employees.

78. How are wages to be paid? A general contractor shall as promptly as possible make payment of all wages due in lawful currency or by negotiable check at par payable on demand.

79. Are safety requirements specified? A general contractor must provide for the safety and welfare of his workmen, complying with all applicable laws governing such matters. Except where such laws otherwise require, he must comply with the safety manual of the A.G.C.

80. Is prison labor allowed? No.

Financing and Accounting

THE code provides for abolishing financial abuses that have disrupted contracting business in the past. Definite forms of accounting may be called for. Disbursement of funds received from a contract is regulated.

81. Is any specific form of accounting required? A general contractor must employ an adequate system of records and accounts, which system shall clearly show the allocation as to each specific project of all funds received or disbursed on account thereof. Standards of accounting, costkeeping and estimating may be proscribed by subdivisions.

82. What are the requirements for disbursing moneys received? Funds received by a general contractor for work performed must be applied first to the payment of amounts due from him to others in respect of any portion of such work, including amounts due employees, materials men, subcontractors and others. Contractors' records must show that all claims against such parties for which the contractor would otherwise be liable have been satisfied or provided for.

83. Is financial aid permitted from subcontractors and materials men? A general contractor shall not permit or require subcontractors or materials men to finance his accounts unless such arrangement is expressly provided for in the original contract between the parties.

ENGINEERING NEWS-RECORD

EDITOR—F. E. Schmitt. EDITORIAL STAFF—V. T. Boughton, W. G. Bowman, F. W. Herring, C. S. Hill, H. W. Richardson, J. I. Ballard, W. W. De Berard, N. A. Bowers.

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Sidewalks and Accidents

PERIODICALLY the layman journalist takes a Roman holiday and turns thumbs down on road-builders because they have not bordered their roads with footpaths for pedestrians. The charge is doubtless justified when restricted to certain specific locations and traffic conditions and when directed against the authorities actually responsible; but few of the critics exercise such moderation. All roads are included and all roadbuilders are pilloried in their conclusions. The modern highway, says the journal which prides itself on its origin in the day of Poor Richard, "has been only half built, it has not been thought out, it has been constructed on half-baked principles." This is charged because all roads do not have sidewalks. And the deaths from automobile-pedestrian collisions are cited in justification. Truly these are sickeningly large—well over a thousand a month in 1933. Yet in all fairness the roadbuilder before he is condemned should be credited with the fact that only one-sixth of these fatal collisions occurred on roads other than city and village streets, which latter almost invariably have sidewalks. By all means let us eliminate pedestrian fatalities on public roads, but let us also direct our efforts a little logically, and with truthful and properly informed regard for fact.

Through Deep Water and Clay

JUST TWO WEEKS AGO as we write, the first of the deep caissons of the bridge across San Francisco Bay to Oakland was seated on bed rock and sealed, after having gone down through more than a hundred feet of water and nearly as much bay-bottom soil. Three similar caissons remain to be landed, some at greater depth. The ingenious method of air flotation adopted, as means of controlling the huge masses of the caissons in their downward progress through water and soft ground, has thus made a success, which is particularly gratifying since the tipping of a caisson of the Mid-Hudson Bridge at Poughkeepsie, N. Y., a few years ago revealed the hazard of instability in such structures, weighing many thousands of tons. That a similar method had been earlier conceived by others for similar (though apparently not identically the same) use is striking proof of the logic with which engineers attack their tasks. But above all the achievement of which the landing of the first caisson is a beginning deserves to be remembered as the successful surmounting of obstacles probably greater than met in any prior bridge foundation. Indeed the foundations have always comprised the principal technical problem attendant to a bridge crossing of San Francisco Bay.

Engineering Applied to Assessment

TWO YEARS AGO engineering principles were applied to the tax tangle in Cook County, Ill., which had gotten its taxing system so thoroughly disorganized that tax billings were two years behind and collections two or three years more. Assessments had become so inequitable that tens of thousands of complaints cluttered the courts. J. L. Jacobs, an engineer, accepted appointment as assessor, in the face of virtually certain public disapproval of what he might do. He revamped the assessment procedure and reorganized the system so that it is now running in better shape and on a more equitable basis than this generation has ever known. The impossibilities of the law by which all real and personal property must be assessed at the same valuations were attacked, and reasonable percentages were accepted; up to then, personal property taxes had been paid, if at all, on a donation basis with little reference to actual holdings. Political influence on tax matters has never been of less consequence than under Mr. Jacobs' administration. Perhaps for this reason not a single political party has his name on its slate (the next assessor being elected instead of appointed). Yet for the good of the community it is to be hoped that the engineering methods which have done so much to clarify the tax muddle in Chicago will survive.

No River Work?

REPORTS from Washington state that the rivers and harbors bill probably will not come up for consideration in the House at this session, chiefly because the President is not in favor of it. This is a curious situation at a time when the Administration professes to be interested in continuing normal productive operations. Failure of the rivers and harbors bill to pass will mean the closing down of much work that depends for its continuation upon regular appropriations by Congress. Last year the country went through a similar experience, when a great deal of construction planned to be done during the 1933-34 fiscal year was shut down by an executive order staying the appropriated expenditures until the new administration could study its problems. But ultimately much of this work was financed by the PWA, the net result being merely that certain normal appropriation expenditures were transferred to the emergency account. Are we to see a similar piece of prestidigitation this year? We cannot believe that the President is deliberately abandoning the work plan of promoting recovery. Only two reasons then remain to account for the unsympathetic attitude toward the rivers and harbors bill: either a naive belief on the part of the Administration in the magic of shifting expenditures from one page to another, or else a desire to eliminate legislative judgment and determine expenditures by executive fiat.

Making Codes Useful

OF ALL THE CODES that have been drawn up under the NRA, none has been approached in a better spirit of understanding or a more sensible attitude of self-help than the lumber code. From the first, the lumber industry saw in code government a road to needed reform. Its meritorious plan for grade-marking lumber had previously been only mildly successful because means of enforcement were lacking; the code provided the missing mailed fist. Needed restriction of new producing units, in the interest of timber conservation, had not been possible in the past; the code again held out hope for success. The lumber industry saw these and other advantages clearly, and drafted its code with definite objectives in mind. Similar objectives have been available to other industries, but many have failed to perceive them. In-

stead they have approached code making as a distasteful task imposed upon them against their will. Old practices, although demonstrably wrong or ruinous, seemed to be too difficult to change or else age had made them sacrosanct, and thus many codes were drawn to perpetuate the old order rather than to improve it. The construction industry, be it said to its credit, has followed the lumber code pattern. And it may be sincerely wished that, in administering their codes, both industries may achieve their thoughtfully conceived objectives.

Mosquito Control

MUCH VALUABLE mosquito control work has been done during the past winter by CWA workers. Its effectiveness, however, will depend upon how well it is followed up this spring and summer. Drainage ditches dug during the winter must be kept open and breeding places must be sought out and sprayed to kill the larvae. This is desirable work for the states and local bodies in taking over the CWA operations. It is specifically listed among the classes of work favored by the Federal Emergency Relief Administration in outlining the possible operations of the work divisions under the change from the CWA set-up. Mosquito control work has lagged in recent years. The present is an opportunity not only to regain lost ground but also to make much greater headway toward complete elimination of a dangerous pest.

A Chance to be Heard

THE American Society of Civil Engineers, sponsor of the Engineers' Code, has extended an invitation to all its local sections and to numerous other societies and individuals to join in working out an Engineers' Code by discussing the latest draft. In reality the invitation is directed to the whole profession of engineering in construction. Thus for the first time all members of the profession throughout the country are given a chance to be heard on the vital subject of a professional code.

This development is eminently constructive. Since no code can be a working success unless it meets equitably the needs of the several parties to its operation, the views and suggestions of all interests should be drawn upon in its preparation. Further, the invitation is timely and welcome because complaint has come from many quarters that the code was being written in star chamber and that the justified claims of some elements were being overlooked or ignored. Those charged with drafting the code had no such intent, we know, but the complications of negotiating with the NRA have up to now made it difficult to avoid the appearance of secrecy.

An abstract of the code, printed in the news pages of this issue, reproduces its essential content as to (1) defining membership in the industry and the relations of various individuals to the code, (2) establishing a code authority with specific powers and duties, and (3) laying down rules of fair practice. In considering it, the engineer should keep in mind the terms of the Recovery Act and the rules laid down by the NRA. From these he may conclude that proposals to write graded pay scales into the code or to fix fee percentages are not in order at present. But all comment directed toward putting professional engineering activities on a sound basis of good business ethics and square dealing will prove useful and constructive.

The profession now has the opportunity to write for itself a basic statute under which it can function efficiently in the interest of greatest public service. Full and incisive discussion will make it possible to convert the opportunity into lasting achievement.

Work of Today

THE CONSTRUCTION INDUSTRY has begun to operate under a code. It now faces the responsible undertaking of converting a written statute into practical reality, into a constructive force of self-discipline and self-improvement. For this purpose it needs to know its code thoroughly and be ready to apply it to every condition that may arise.

In this issue we present a statement, in digest form, of the terms of the contractors' code and the answers to typical questions concerning its application, so far as the document itself supplies an answer. Prepared by careful students of the code and checked by contractors and legal authorities close to the administrative officials, it is as full an analysis as is possible today. But no code or law as written can meet every demand of application to fact; so here, the code of contracting will not be a complete working code until it has gone through the test of time and repeated interpretation by its constituted judicial authorities.

The code itself, indeed, is barely more than a blank form. Operation will show its weaknesses and blind spots. Administrative and judicial action in the light of the problems of practice will put substance into its formal rules. And unquestionably a broader and more effective body of industrial law will emerge from these practical interpretations than resides in the words of the code as now written.

Thus the real writing of the code is now just beginning. It is a greater task than the drafting of the document that was so long fought over before it received the approval of General Johnson and the President, and it calls for at least equal qualities and effort—sustained and persistent labor coupled with honesty, impartiality and wisdom worthy of a high court of justice. And these in turn are likely to have an unsubstantial existence at best if the enforcement of the code is not demanded and supported by the industry as a unit. Unless each single member by his aid and cooperation shall uphold the authority of those who administer the code and strengthen their decisions, the hope of industrial rehabilitation is likely to meet disappointment.

Let us remember that the code is a statute of self-government, not a restrictive law imposed from without, but the industry's own creation. Its enforcement also is the industry's responsibility. And this means the responsibility not of a few but of all; it is everybody's job to make the code effective, through complete self-organization and cooperation based on clear understanding of purpose and spirit as well as of terms.

The work to be done now is to apply the code to the employers who constitute the industry of contracting. Habits of fairness and square business method can once more prevail when competitive practices are reformed and rejuvenated. Once this basic reformation is accomplished it will be possible to work toward the larger ultimate objectives of the code—improvement of the art and its industrial methods, stabilization of its activity, and betterment of the workers' status and security. The foundation of all these aims is the solid establishment of code practice by the power of countrywide cooperation.

CURRENT NEWS

RFC Financing for Municipal Works Up to Congress

PARTICIPATION of the Reconstruction Finance Corporation in financing municipal public works will be discussed with the congressional banking committees by Jesse Jones, chairman of the board. Mr. Jones said that he is favorably disposed to the proposal but that decision is up to Congress. He expects to tell the Senate and House committees what might be accomplished if the RFC was given authority, in conjunction with the Public Works Administration, to purchase municipal bonds for financing self-liquidating public improvements and thus conserve PWA funds for outright grants representing 30 per cent of the cost of labor and materials.

The RFC probably will draft the bill but it may be submitted without recommendation. The board has discussed the proposition but is not committed to it. The plan appeals to Chairman Jones personally as a temporary aid to the municipal bond market. In his opinion, the plan would not require much money as the RFC could sell the bonds as soon as the investment market improves. The RFC's operations, as visualized by Mr. Jones, would be limited to high-grade municipal and county bonds. Participation by the RFC would not preclude the PWA from making loans as it has done heretofore on approved projects.

Mr. Jones said that it is too soon to estimate how much RFC money would be available for financing projects. Congress may, he said, decide to set up a revolving fund of definite amount. There is a prospect that ample funds will be available since, with general improvement of conditions, the demands on the RFC are slackening noticeably. RFC commitments will fall short by about $500,000,000 of reaching the total of $3,900,000,000, by the close of the fiscal year, estimated when the budget was submitted last December. The corporation's unused borrowing power beyond commitments totals approximately $1,000,000,000 plus repayments since January 1 of $250,000,000.

Federal Housing Corporation Plans to Speed Its Program

It has been announced that condemnation proceedings will be resorted to by the Federal Housing Corporation to speed its construction program. Already the assembling of the necessary land for housing projects is under way in five cities. Wherever it is considered necessary, because of inflated real estate valuations, the corporation plans to seize the necessary land for its activities and settle for damages later. The corporation is not to be held liable for municipal taxes, but will expect to pay for water and other municipal services to be supplied by the cities where projects are built.

Construction League Will Affiliate With State Groups

State Construction Leagues are eligible for affiliation with the Construction League of the United States as a result of a decision of the Policy Committee at a meeting March 24. These local groups are to consist of local chapters or branches of the member organizations of the national League and provision is also made for membership in the State Leagues for local groups which have no national organization or whose national organizations are not members of the Construction League. After approving regulation for state leagues the committee elected five organizations as state leagues of the national body. These are: California Construction League, Alabama Construction League, Connecticut Construction League, Michigan Construction League and the Indiana Construction League.

The Policy Committee also elected the National Elevator Manufacturers Industry to full membership.

Relative to the question of private financing for construction, the committee adopted the resolution advocating federal assistance in releasing credit for construction work and recommended that the Fletcher-Steagall Bill for "Credit Banks for Industry" be amended and used to provide such assistance.

Muskingum District to Start Construction of Dams

With the signing of a contract for a loan of $500,000 to the Muskingum Watershed Conservancy District, Ohio, the corps of engineers will begin active work on a construction program which includes 14 dams to be built by the federal government for flood control on the Muskingum River, a tributary of the Ohio River, draining the southeastern section of the state. Temporary construction headquarters will be located at Zanesville and field parties are already at work. A PWA allotment of $22,090,000 has already been made to cover construction work and the district has agreed to provide $12,000,000 in financing for the purchase of land to be flooded and the relocation of highways and railroads.

According to the present program, construction work will go forward on all of the dams concurrently and will start as soon as negotiations have been completed for rights of way and reservoir sites.

The district was organized in June, 1933, under the conservancy act of Ohio, and includes all or part of 16 counties involving about 8,000 sq.mi. or roughly one-fifth of the state area. The district is empowered to levy taxes, borrow money and make assessments for the providing and maintaining of these works. The Muskingum Valley has experienced several disastrous floods, particularly one in 1913 which resulted in damage estimated at $14,000,000. The program calls for flood protection, water conservation, irrigation, forestation and soil erosion control.

Engineers' Code in Revised Form Before the NRA

A REVISED DRAFT of a code for the engineering division of the construction industry was submitted to the National Recovery Administration on March 24 by the code committee of the American Society of Civil Engineers with request for an early public hearing. This revised draft of the code was approved by the executive committee of the society at a meeting held in Washington on March 23. The executive committee at the same time authorized the appointment by the president of a committee on codes. Subsequently Harrison P. Eddy, president, appointed Dean G. Edwards, New York; Frank A. Marston, Boston; Frank A. Randall, Chicago; and Henry J. Sherman, Camden, N. J., members of the committee on codes. Carlton S. Proctor, New York, is chairman of the committee, having been appointed by the executive committee last summer during the early stages of the code work.

The executive committee authorized the committee on codes to associate with itself the following representatives of other interested societies: Institute of Consulting Engineers, Gavin Hadden; American Society of Mechanical Engineers, Henry C. Meyer; American Society of Heating and Ventilating Engineers, John G. Eadie. An appropriation was made for the use of the committee

It is planned to have Dean G. Edwards added temporarily to the staff of the secretary in order to keep local sections and others interested in the code development in close touch with progress on the code.

Revised code

The revised draft of the engineers' code is an attempt to harmonize proposals made in a redraft of a code for the engineers division of the construction industry, prepared by the staff of the NRA late in January following a review of proposed drafts then before it, with the views of those outside of the NRA who believe some of the proposals made in the NRA draft would be unworkable.

The revised draft includes only two methods of practice, i. e., professional engineering and engineering-construction, in place of the six methods proposed in the NRA draft, professional engineering, general engineer-construction, specialized process engineer-construction, sales engineering, engineering construction, surveying. Professional engineering is defined as including the providing or undertaking to provide and be responsible for unbiased professional engineering services and permits full latitude in directing, correlating and supervising construction and installation where such services do not include responsibility for construction performance or the contractor's responsibility for the work. The engineer-construction method of practice is defined as including the providing or undertaking to provide and be

responsible for services defined in this section when combined with responsibility for construction performance, or contractor's responsibility for the work. When parts of the engineering services are incident to patented devices or specialized processes which are of such nature that the engineering incident to their design and installation is not in competition with the engineering services offered under either of the two methods of practice outlined above, such engineering function, so limited, shall not be considered as subject to the provisions of the chapter governing the engineering division of the construction industry except as those persons performing such functions, so limited, assent to control under that chapter and are admitted as members of the division by the divisional code authority.

Engineering service

Engineering services, as defined in the code, "shall include the offer to provide, or the providing of, engineering service such as, but without limitation, investigation, surveying, planning, design, supervision, inspection, engineering testing or laboratory analysis for the construction or anticipated construction of any private or public buildings, structures or works, or construction accessory thereto, where such services involve a knowledge of engineering laws, formulas and practice, and a knowledge of the physical properties of the materials of construction and methods of installation.

The code contains a clause exempting the engineering function normally included in the work of an architect.

An engineer is defined as (a) one who is registered or licensed in accordance with the provisions of law to practice engineering, or any branch thereof, within any state or territory of the United States; or (b) one who is admitted to, or is eligible by reason of technical training for admission to, membership in established national or regional professional engineering organizations in grades which require, as a condition of membership, active practice in engineering for not less than eight years, with evidence of competency to be placed in responsible charge of engineering; active practice and responsible charge of engineering to be construed as fulfilled only when embodying the design of engineering works and/or the direction of engineering functions.

An engineering assistant is defined as any individual "not registered or licensed by any state or territory to practice engineering as a profession, or not eligible for membership as hereinbefore defined in any professional engineering organization, providing for membership as hereinbefore described, who is employed to render technical or other services of a sub-professional nature under the direction of an engineer."

Administration

The code is to be administered by a divisional code authority consisting of eleven members, one each appointed by the American Institute of Consulting Engineers, the American Society of Mechanical Engineers, the American Society of Heating and Ventilating Engineers, five to be named by the American Society of Civil Engineers to represent the professional engineering methods of practice in its sev-

(Continued on p. 455)

TVA Places Orders for 315,000 Barrels of Cement

Orders for 315,000 bbl. of cement, totaling $661,500, have been placed by the Tennessee Valley Authority to be used in the construction of Norris dam and General Joe Wheeler dam. The total number of barrels purchased for Norris dam is 215,000, about one quarter of the amount of cement required to build the dam. Orders were placed with the following companies: Volunteer Portland Cement Co., Knoxville, Tenn., 125,000 bbl.; Penn-Dixie Portland Cement Co., Kingsport, Tenn., 45,000 bbl.; Signal Mountain Portland Cement Co., Chattanooga, Tenn., 45,000 bbl.

The cement order for Wheeler Dam totaled 100,000 bbl., about one-sixth of the ultimate requirement for this project. Contracts for the Wheeler requirements were awarded the following companies: Lehigh Portland Cement Co., Birmingham, Ala., 35,000 bbl.; Alpha Portland Cement Co., Birmingham, Ala., 35,000 bbl., and Cumberland Portland Cement Co., Cowan, Tenn., 30,000 bbl.

F. W. Hanna Resigns Post With East Bay District

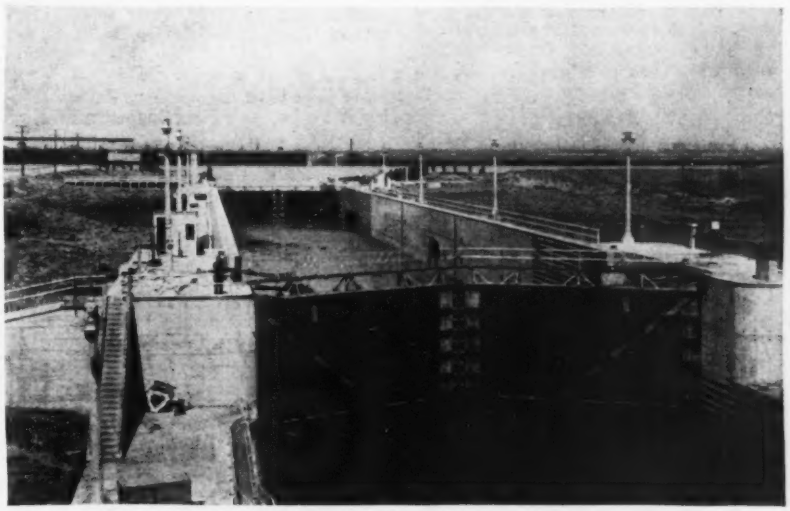
F. W. Hanna, since 1929 chief engineer and general manager of the East Bay Municipal Utility District, Oakland, Calif., resigned his position on March 31. He intends to retire from active engineering practice.

Earlier in his career Mr. Hanna spent a number of years with the Reclamation Service as supervising and consulting engineer. From 1912 to 1924 he was general manager of the Canadian Land and Irrigation Co., Medicine Hat, Alberta. He entered the service of the East Bay district in 1924, as engineer in charge of designs and hydraulics. He became chief engineer and general manager in May, 1929, succeeding the late Arthur P. Davis.

Mr. Hanna is the author of a number of articles on irrigation and agriculture and a book on dam design.

Campaign Against Unlawful Use Of "Engineer" Succeeds

A campaign to eliminate improper listings as "engineer" from telephone and classified directories, has met with success in New York, according to a report of the New York State Society of Professional Engineers. Out of 113 listings that were challenged, 52 have already been withdrawn from the New York telephone directories and others are in the process of correction. The plan is to extend this campaign into other counties. The New York law makes it illegal for any individual to announce to the public that he is an engineer or to use the designation engineer unless he holds the state license. The officers of the society have conferred with representatives of the telephone company to establish complete cooperation in this program of law enforcement, and the self-styled engineers have been notified to discontinue their listings.



NEW HARVEY CANAL LOCK, NEW ORLEANS

A new lock providing connection between the Mississippi River at New Orleans and the enlarged inland waterway extending 275 miles westward to the Sabine River in Texas, was opened on March 26 with formal ceremonies attended by local, state and national officials, including John Klorer, chief engineer, Orleans Levee Board; Col. Warren T. Hannum, division engineer, and Major Henry Hutchings, Jr., division and district engineers under whom the canal was built, Brig.-Gen. Harley B. Ferguson, president of the Mississippi River Commission and Major-Gen. Edward N. Markham, Chief of Engineers, U. S. Army.

The new lock is 425 ft. long, 75 ft. wide and 12 ft. deep over the sills and replaces a much smaller lock lying just to the east. The work of enlarging this section of the intracoastal waterway to a minimum bottom width of 100 ft. and a depth of 9 ft. has been in progress for some years and is now approaching completion. The accompanying photograph shows the new lock and is taken looking across the Mississippi River to New Orleans. The lock is designed to compensate for differences between the level of water in the canal and in the Mississippi River and to keep flood waters in the river from going out through the canal.

In the evening, following the dedication services at the lock, a banquet was given in honor of General Markham.

Progress Made on Chapters for Construction Code

APPROVAL was given to Chapter IX of the Construction Industry Code covering the Tile Contracting Division on April 2. Because the number of employees is less than 50,000, the Administrator's approval is final, as provided in a previous executive order, and this chapter becomes effective April 12.

Proposed chapters for the Mason Contractors Division and the Electrical Contracting Division have been approved by the deputy administrator and the division administrator and final approval is pending. A new draft of the proposed chapter for Architects was submitted by the Code Committee of the A. I. A., on March 23, and is under consideration; and a revised draft was submitted by the Professional Engineers Code Committee on March 24.

A committee is at work assembling statistics to accompany an application by the Construction News Service Companies for a chapter under the code. These companies feel that they would be more at home if codified as a part of the construction industry to which the Construction News Service is furnished, rather than under publications codes, when their business is service rather than publishing.

The code proposed for the Engineering Materials Inspection Industry is understood to be in process of being combined with the Code for Commercial Laboratories, and will not be under the Construction Code. As redrafted, it is said not to conflict with the proposed Professional Engineers' Chapter.

A separate code submitted for the Bituminous Paving Industry is still pending, although it is understood that a decision has been made that laying bituminous materials on the roadway is already provided for in the General Contractors' Division, Chapter II, under Highway Contractors' Subdivision, and that a separate code, therefore, could only cover the operating of bituminous mixing plants.

PWA Board of Review Calls Experts in Chicago Work

In the course of the investigation now under way by a PWA board of review into the plans of the Sanitary District of Chicago to make sure that they have taken full advantage of all developments of the art of sewage treatment, George W. Fuller, Harrison P. Eddy and John H. Gregory have been called to Chicago. Informal conferences were held starting March 26 with the consultants in rotation, the questions being held to policy which the present situation at Chicago would seem to demand in the light of present day thinking. General deductions only were gone into. The board of review consists of Daniel W. Mead, Brig. Gen. Charles W. Kutz, W. B. Storey and Joshua D'Esposito. To assist the board G. Gale Dixon, Youngstown, O., S. W. Freese, Fort Worth, Texas, and Major E. F. Robinson, Syracuse, N. Y., have been employed.

George A. Johnson, Prominent Sanitary Engineer, Dies Suddenly

George A. Johnson, consulting sanitary engineer of New York City, died suddenly in his office in that city on March 31. His death was due to heart disease.

Mr. Johnson was born in Auburn, Maine, in 1874. His engineering career began in 1895 when he became a junior member of the technical staff, which, under the direction of George W. Fuller, studied the efficiency of rapid sand filtration in purifying Ohio River water at Louisville, Ky. The report of that experimental work became a classic of sanitary engineering literature. Following the Louisville work he was connected with similar studies at Cincinnati, Ohio, and in 1899 he became an assistant on the tests undertaken at Washington, D. C., to determine the relative efficiency of slow and rapid sand filtration in the purification of Potomac River water. In 1902, following other studies on the water purification problems at St. Louis and at Philadelphia, he was placed in charge of the operation of the newly built Little Falls, N. J., filter plant of the East Jersey Water Co., which served Paterson, Passaic, Montclair and other New Jersey communities.

In 1903 he was made field director of the Burr-Freeman-Hering commission on additional water supply for New York City. He went to Columbus, Ohio, in 1904 as engineer in charge of investigations, under Julian Griggs, of water-softening and sewage-treatment methods suitable for that city.

Following his Columbus engagement Mr. Johnson became professional advisor to the Jewell Export Filter Company, in connection with improved water supply projects in Japan, China, Ceylon, India, Egypt, France and England. In that connection he made a tour of the world.

He joined the engineering staff of Hering & Fuller, consulting engineers of New York City, in 1907 and became a member of the firm during the following year. It was in 1908 that he made the first notably successful attempt at chlorination of a public water supply by the application of calcium hypochlorite solution to the raw water at the Bubbly Creek (Chicago) filter plant. In the same year Mr. Johnson and Professor Leal commenced the chlorine treatment of the Boonton supply at Jersey City, N. J. In view of the great quantity of water treated, 40 m.g.d., this was an epoch-making venture.

Mr. Johnson entered private practice in 1910, in partnership with W. B. Fuller, in New York City. In that connection he served as engineer on the water and sewage problems of a number of cities.

He was commissioned a major in the U. S. Army in the spring of 1918, being promoted to the rank of lieutenant colonel later that same year and to colonel in 1919. While in the service he directed the technical management of all fixed properties and utilities in the military establishments coming under the jurisdiction of the War Department, including buildings, roads, railroads, electric light and power plant systems, refrigerating and heating plants, water supply works, sewerage and sewage disposal systems.

Following his discharge from the army in 1920 he again entered private practice as consulting engineer, in partnership with W. L. Benham.

Mr. Johnson, though aggressive, was very genial in personality and was highly successful in conciliating opposing points of view. He was widely known among sanitary engineers and was the author of many technical papers. At one time he was very active in the American Water Works Association and in 1920 he promoted the reorganization plans which altered considerably the association activities.

Shrinking Revenue in Cleveland Leads to Drastic Economies

As a result of the refusal of the Ohio legislature to pass a bond-refunding bill, proposed by Cleveland, and which would have permitted a diversion of sinking fund money for operating expenses, a drastic curtailment of municipal services to shrink expenses within the $7,260,000 of probable income is under way this week. The cuts ordered approximate $4,000,000 with the most severe blows falling on the fire and police departments because they constitute the largest expense of the city with payrolls totaling $5,700,000 annually. In payment of back bills and other expenses, the city has already spent $3,000,000 of the $7,260,000, leaving approximately $4,000,000 for remainder of 1934.

The full retrenchment program calls for economies totaling $4,053,000 on an annual basis, but include $1,850,000 from the police and fire departments alone.

Of the city departments, the department of public service under Director William F. Eirick appeared to be the most severely hit by the enforced economies. The street cleaning department was cut from $661,000 to $300,000; the garbage department cut from $499,000 to $249,000; the department of engineering and construction cut from $48,000 to $23,000. Henceforth, rubbish and ashes will not be collected unless householders place them at the curbing in front of their houses; will only be collected then about once a month as contrasted with a frequency of from 10 to 14 days heretofore. An earlier decision to lock open four bridges across the Cuyahoga river channel has been rescinded since the saving from dismissing the bridge tenders has been found to be completely insignificant.

The closing of several divisions of the city hospital and the curtailing of other city health services are regarded as possible necessities, unless a way is found quickly to divert gasoline tax funds to make up the operating deficit of this division of the welfare department, about $70,000.

Other major items slashed include: Boys' home cut from $21,000 to $10,000, girls' home cut from $62,000 to $30,000, employment bureau cut from $15,000 to 5,000. Meat and dairy inspection cut from $92,000 to $22,000. Tuberculosis expense cut from $201,000 to $181,000. Municipal court cut from $230,000 to $100,000. City Council cut from $97,000 to $57,000. Parks and boulevards cut from $222,000 to $72,000. Street lighting cut from $1,200,000 to $750,000.

All policemen and firemen have been asked to work full time but at half pay, until the question of issuing deficiency bonds is definitely settled.

A deficiency bond issue to restore public services now being reducd or eliminated

is before the legislature this week. If passed by the house and senate, substantially as presented, it would permit Cleveland to issue deficiency bonds in an amount approximately representing the difference between the city's operating needs ($12,688,000) and the amount it can now anticipate from normal sources of revenue ($7,260,000).

A fixed tax rate on a shrinking tax duplicate is at the bottom of Cleveland's financial difficulties of the moment. Equally fundamental in the long-range view of the situation is the struggle between strictly rural counties and urban counties of the state of Ohio, with the rural counties trying to hang the cost of roads, schools, libraries, etc., on the 8 urban counties of the state. Also to be considered is the fetish for tax limitation in Ohio as a means of cutting down public expenditures, or keeping them well within control. This was what was back of the action of the Ohio voters last fall when they voted to amend the state constitution to relieve real estate of part of its tax burden while ignoring the fixed debt charges of municipalities and at the same time making no allowance for the increasing sums of public money necessarily diverted to community relief work. Cleveland's city administration had hoped to have $12,688,000 for operations this year, but it is now apparent that no more than $7,260,000 is at all likely to be forthcoming in regular revenue.

Study of Twin Cities Project Shows Saving By PWA Grant

A comparison of the costs of constructing the Minneapolis-St. Paul $18,000,000 joint sewerage project under PWA auspices and private financing, made on the basis of the same wage scale, shows that the increased cost due to the PWA regulations will be not more than 6 per cent, according to a report submitted to the trustees of the Minneapolis-St. Paul Sanitary District by C. C. Wilbur, chief engineer. The reports show that there will be a net saving to the district of over $3,000,000 by accepting the PWA grant.

The report concludes, "The advantages of accepting the federal grant, including chiefly a net saving of at least $3,000,000, are of such importance that the cities and the board cannot properly in the interest of economy consider the discarding of PWA financing at this time."

Mr. Wilbur had been ordered by the trustees of the sanitary district to submit comparative cost figures on PWA financing and financing through private banking channels to settle a question that had arisen regarding the advisability of accepting the PWA grant in view of the conditions involved in government financing.

Although an allotment of $18,048,000, which included grants of $4,212,000, was approved several months ago, a number of delays have prevented the consummation of the bond contracts. On March 27 the contracts were sent out from Washington signed by the PWA officials.

The conditions involved in PWA financing which the trustees feared might result in added expense greater than the amount of the grant were: an added cost for bonds and compensation insurance, and extra cost due to the fact that the PWA requires all labor to be provided through government channels.

Engineers Code Before NRA

(Continued from p. 453)

eral branches, and three to represent the engineer-construction group. The code authority may be rearranged to make it truly representative should further methods of practice be added. The non-voting members of the construction code authority appointed by the Administrator may also serve on the divisional code authority.

The divisional code authority may delegate its powers as it deems necessary and shall cooperate with the Administrator in making investigations as to the functioning and observance of the code, also may recommend changes in the code to the Administrator. It shall receive, and so far as possible adjust all complaints as to trade practices between members of the division. It is authorized to require the registration of all contracts or agreements for engineering services, and those combining engineering with construction, entered into by members of the division, and for which the charge for engineering services is estimated to exceed or does exceed $400, and in order to defray the expenses of administration may collect a registration fee on members' contracts in amount not to exceed one-half of 1 per cent of the charge for engineering services, except that it may establish a minimum registration fee of $5 or less. Funds so collected shall be used to defray its expenses and to bear its proportionate share of the expenses of the authority.

Fair practices

Under the heading of fair practices the code requires that each member of the division before proceeding with an engagement for engineering services or engineering services combined with construction performance, for which payment for engineering services is estimated to exceed $400, shall enter into a written contract or agreement with the client. No member is permitted to give any rebate, discount, bonus, fee or commission to a client or prospective client to influence or procure an engagement.

Subsequent to the selection of a member of the division, as evidenced by written agreement, no other members shall offer to provide any competitive engineering services.

No member shall permit plans or specifications to be issued on his behalf without signature or stamp to indicate his technical responsibility.

In all engineering services where employees are placed in a position supervisory of engineering and in positions from which the principles of the engineering may be dictated, such employees shall be engineers. If the character of the work requires architectural, specialized engineering or other technical services, supplementary to those normally rendered by the engineer, he shall employ or recommend the employment of such specialists.

No member shall submit his design drawings or specifications for bids until he has developed adequate preliminary information, and he shall observe fairness in making known all the requirements of the work to all bidders alike.

No member shall acquire or otherwise benefit by the purchase of real estate or business interests which may be affected by an engineering work for which he shares responsibility except with the full knowledge and consent of his client.

No member shall invite or accept engineering designs, studies or inspection of construction materials from a contractor or supplier of materials interested in the work or in the bidding where such services are the responsibility and duty of the member of the division. Shop drawings and producer's technical trade information are excluded, and this provision does not prohibit any member operating as an engineer-constructor from full cooperation with his construction or operating organization, or with any member practicing as a professional engineer.

No member shall make a charge to a client for engineering services less than the cost of such services as determined in the method outlined below. The code states further that this provision is not for the purpose of indicating the fair or proper charges, but is for the purpose of setting a minimum limit. It states further that this minimum limit does not adequately provide for many cases where specialized training, experience and practice are to be furnished.

Cost shall be considered as the actual cash expenditure chargeable to the work plus salaries paid to the principals for the time they actually spend on the work at an adequate rate, and not less than the highest salary paid to any member of the organization or employee actually engaged on the project in question, plus the cost of specialists employed by the member of the division, plus overhead applied to the payroll cost and principals' salaries; the overhead factor to be determined by a method prescribed by the divisional code authority. Prior to such prescription the minimum overhead factor shall be determined by each member from its own cost records and shall include all items of office expense and a proper share of engineering and other payroll costs and of expenses not assignable to definite projects, and may include a proper share of executives' or principals' time not assignable to definite projects and of equipment obsolescence to compensate for the readiness to serve and the professional responsibility assumed. The code provides further that when a client must determine in advance definite limits of cost, the engineer may agree in advance to a percentage or lump sum when such charges are in accordance with charges which are authoritatively established for such services or when such charges represent an honest effort to meet the conditions set forth in the above method of determining cost.

No member of the division shall represent that he will provide, or does provide, engineering services—consultation and preliminary investigation excepted—at less than the cost defined above, and to make a charge less than the cost so defined constitutes unfair practice.

No member of the division shall misrepresent the character of his services or those of a competitor or make unfair, untrue statements concerning a competitor or take action tending to induce cancellation of a competitor's orders, agreements or contracts.

Members of the division are required to provide adequate and sufficient field supervision and inspection and to be reasonably prompt in accepting or rejecting parts of the work as it proceeds, where the duty to accept or reject comes within the province of the engagement.

Home Modernization Program to be Announced Soon

ANNOUNCEMENT of the Administration's program of home repair and modernization is expected to be made soon. A cabinet committee which has been studying the feasibility of a national campaign for several weeks has reached the conclusion, according to Frank C. Walker, executive director of the National Emergency Council, that such a program would be an important factor in recovery, particularly in heavy industries. A subcommittee of the House Committee on Banking and Currency, under the chairmanship of Representative Reilly, of Wisconsin, is holding itself in readiness for hearings on the bill when submitted. Consideration of several other bills has been temporarily suspended.

Entire emphasis is put upon modernization of existing homes but it is understood that some new construction also will be financed. No reliable estimate of the probable extent of the program has been made other than that contained in Mr. Walker's statement to the effect that the council has been advised that "general reparation and remodeling of homes will result in expenditure of at least $1,000,000,000."

No direct loans will be made and the federal government's contribution to the program will be comparatively small as the plan preferred contemplates the guarantee, in part, of loans made by private agencies such as banks, mortgage loan companies, insurance companies and building and loan associations. The theory of the program is that idle capital can be mobilized if the federal government offers some sort of guarantee on the investment, and that unemployment aggravated by attenuation of the CWA in the new works divisions which employ only those actually in need, will be reduced.

The contemplated program is not of emergency, quick-acting character but one which is expected to indicate more or less definitely the future relationship of the government to housing in its social, physical and financial aspects. It will not commit the government to the outlay of a vast fund for drives such as have been proposed by construction and real estate interests, but will be directed rather to increasing the utility of existing private agencies whose machinery, in general, is regarded as adequate.

Inducing insurance companies, building and loan associations and other home financing institutions to loan funds for modernization is regarded as practicable because, in most cases, existing mortgages have been reduced to a figure permitting a further loan for renovating which in turn increases the security for the whole obligation.

In anticipating new construction, it is expected that the Administration will strike at the root of the problem, which is financing. Short term loans of 3 to 5 years for home building, the basis of present practice by most institutions other than building and loan associations, are regarded as incongruous in the face of the fact that the debt incurred by the home builder can only be discharged over a long period. The real possibilities of better adapting home financing facilities to the needs of the situation are appreciated by the President's advisors but legislation designed to put the federal government in a position where it can bring pressure to bear on remedying the fundamental situation requires time for consideration.

Precedent for the present federal move toward home modernization is based largely on the initial experiences at Rochester in 1931 and the well known campaign in Philadelphia early in 1933. This latter program was preceded by a three-months' intensive drive of public education to secure community support.

SLUM-CLEARANCE HOUSING BECOMES A REALITY IN NEW YORK

More than half of the steel frame for the first of the two 12-story buildings of the Knickerbocker Village development on New York's lower east side is completed, and progress is being made steadily on the foundations of the adjacent second building. Each building is in the form of a hollow square inclosing a 130x230-ft. court. (See *ENR*, April 13, 1933, p. 481 for an architectural rendering of the buildings.) Knickerbocker Village was designed and is being built by the Fred F. French Co. with an $8,000,000 RFC loan. The tall steel frame in the background is the new Federal Office Building, first addition to New York's skyline for several years.

Federal Contract to Second Low Bidder to be Paid on Low Bid

Funds to the amount of only $1,874,000 will be allowed for payment to the Dravo Contracting Co., Pittsburgh, for construction of the twin locks and central control station at the site of the new government dam at Winfield, West Virginia, on the Kanawha river, according to information from Washington.

The Dravo company, which is now well advanced with its construction work at Winfield, submitted an original bid of $1,921,130 and a contract specifying this amount was signed with the U. S. Engineers district office at Huntington although the Brader Construction Co., New York, submitted the low bid of $1,874,000. The contract was awarded the Dravo company on the grounds that the Brader company was not equipped to begin the work at once, and would not be able to start for some time.

Despite Comptroller General McCarl's original ruling, issued in January, and stating that the contract should have been given to the low bidder, the Dravo concern has never stopped work at Winfield. McCarl says that upon completion of its work, the Dravo company might submit a claim to him for the additional $46,630.

St. Francis Levee Board to Sell $552,000 Bonds to PWA

Levee work to secure maximum flood protection for northeast Arkansas and solvency for the St. Francis Levee Board was assured when the board authorized the sale of $552,000 in bonds to the PWA. The proceeds will be ample to complete the board's share of the Jadwin flood control plan along the west bank of the Mississippi River from the Missouri line to Helena, Ark., providing a territory of 1,600,000 acres in eight counties with 50 per cent greater protection against floods, according to Harry N. Pharr, board engineer.

Otis E. Hovey Resigns as American Bridge Co. Consultant

Otis E. Hovey, consulting engineer of the American Bridge Co. at New York, retired from this position on March 31, after thirty-eight years of continuous service with the company and the Union Bridge Co. of Athens, Pa., one of its predecessors. Mr. Hovey has been active in the field of bridge construction since the early '90's, when, after two years at Washington University, St. Louis, as instructor in civil engineering he took charge of the designing office of George S. Morison in Chicago. During this period the Bellefontaine, Alton, Leavenworth and other major bridges were built under Mr. Morison's direction. In 1896 Mr. Hovey became engineer for Union. Upon its merger with other companies in the American Bridge Co. in 1900 he became engineer of design, later assistant chief engineer, and three years ago consulting engineer. He has been largely concerned with movable bridges, and is the author of a two-volume treatise on the subject (1926).

Mr. Hovey plans to continue in the field of bridge construction as consulting engineer in private practice.

Personals

J. WALTER ACKERMAN, formerly city manager of Watertown, N. Y., and Fall River, Mass., has been named assistant to general manager of the Consolidated Water Co., Utica, N. Y.

W. G. STROMQUIST, for the past six years director of the Jefferson County (Alabama) board of health, has been engaged as a sanitary engineer with the TVA. One of his principal functions will be malaria control in relation to impounded reservoirs.

R. W. KRUSER is now junior engineer, Division of Management, Bureau of Public Roads, Washington, D. C. He was previously with the Tennessee Valley Authority, working on reservoir surveys.

DARWIN W. TOWNSEND has become associated with the consulting firm of Consoer, Townsend, Older and Quinlan, Chicago, Ill. He has relinquished his position as acting chief engineer of the Milwaukee Sewerage Commission, and will be located in the Milwaukee office of the firm.

ARTHUR T. SAFFORD, engineer of the Proprietors of Locks and Canals on the Merrimac River, and consulting hydraulic engineer at Lowell, Mass., has been elected president of the Boston Society of Civil Engineers. Mr. Safford is a native of Chicago and was educated at Williams College, receiving his A.B. in 1887, an A.M. in 1890 and the degree of Sc.D. in 1927. He was assistant engineer with the Massachusetts State Board of Health from 1887 to 1891; assistant to the city engineer of Newton, Mass., from 1891 to 1898; and engineer of the Boston Metropolitan Water Supply from 1893 to 1894. In the last-named year he also became associated with the Locks and Canals organization and served as an assistant engineer until 1917, when he was appointed engineer of the enterprise. Since 1904 Mr. Safford has maintained a consulting office at Lowell.

Obituary

WILLIS W. SNYDER, 67 years, president of the Snyder-Gillett Contracting Co., Niagara Falls, N. Y., died in that city March 29.

HARRY P. LETTON, consulting sanitary engineer, Lincoln, Nebr., died in Chicago, at the age of 47. He was a member of the firm of Grant, Fulton & Letton from 1919-28.

EARL C. BROWN, vice-president and manager of the St. Louis branch of the Mississippi Valley Structural Co., died March 27, in St. Louis. Mr. Brown had been with the company continuously since his graduation from the University of Illinois, 1907.

CONSTRUCTION STATISTICS OF THE WEEK

ENGINEERING AWARDS at $19,541,000 are 33 per cent lower than last week, and 19 per cent below the average week to date this year. The largest drop, 37 per cent, is in state and municipal awards. Federal contracts are more than twice last week and almost double the previous 4-weeks' average. Private awards are 17 per cent below last week.

Streets and roads drop again to the second lowest week of the year, $4.9 millions compared with $6.1 millions last week. Earthwork, irrigation and drainage are up, $3.3 compared with $1.4 millions last week. Sewerage contracts are below the record high of last week but well above the average week to date, $1.6 millions. Bridges are below last week but well above the previous 4-weeks' average. Industrial buildings are ahead of last week, $2.1 millions, while commercial buildings are the lowest for the year, $0.3 millions. Public buildings are only slightly lower.

Large contracts include the Gulf oil refinery at Philadelphia $1,000,000; highway letting in Georgia $765,000; North East Boundary Sewer Extension, Washington, D. C. $585,000; bridge over Missouri River including highway at South Omaha by Omaha Bridge Commission, $1,278,000; emergency gates and needle valves for Boulder Dam $515,000; dredging in Miami Harbor, Fla., $1,974,000 and steel rails and track fastenings for New York Central Railroad estimated at $1,400,000.

No PWA allotments were announced during the week. Municipal bond sales were up, 65 per cent ahead of last week. The contract curve has crossed the new capital curve since the rate of setting up new capital has dropped below the rate of putting work under contract.

CONTRACTS

(Thousands of Dollars)

	Weekly Average Apr. 1933	Prev. 4 Weeks	Week Apr. 5 1934
Federal Government	$1,756	$3,408	$6,489
State and municipal	5,060	13,449	8,607
Total public	$6,817	$16,857	$15,096
Total private	5,531	7,636	4,445
Week's total	$12,348	$24,493	$19,541
Cumulative to date:			
1933.....	$231,095	1934.....	$322,587

NEW PRODUCTIVE CAPITAL

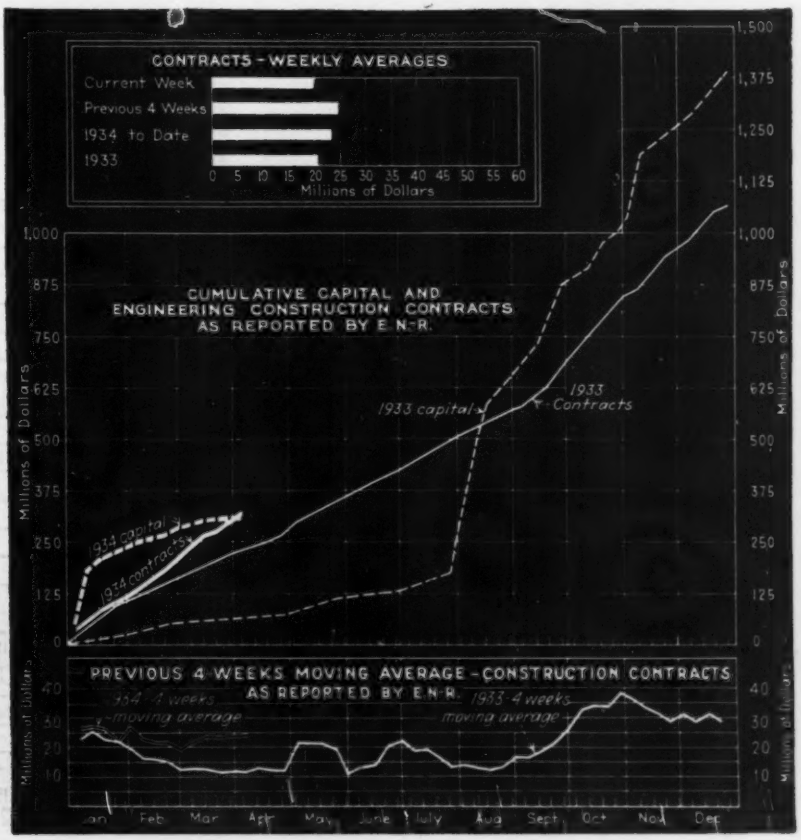
(Thousands of Dollars)

1934	Week Apr. 5	Cumulative
State and municipal....	$4,261	$59,616
PWA allotments, S&M...	....	197,925
Corporate issues	....	10,595
PWA allotments, private	....	44,831
Total, Non-Federal....	$4,261	$312,967
PWA allotments Federal Constr.	....	48,102
Total new capital.....	$4,261	$361,069
Cumulative to date:		
1933..... $68,886	1934.....	$312,967
Rescinded or reduced allotments (from 1933 PWA totals).....		$43,323

NOTE: These figures include private bonds and stock sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for Federal construction.

INDEX NUMBER

E.N.-R.-Cost		E.N.-R.-Volume	
April, 1934.....	195.86	March, 1934.....	108
March, 1934.....	194.04	February, 1934...	88
April, 1933.....	160.16	March, 1933.....	62
1933 (Average)...	170.18	1933 (Average)...	102
1932 (Average)...	156.97	1932 (Average)...	127
1931 (Average)...	181.35	1931 (Average)...	220
1913 (Average).....	100		


CONTRACTS - WEEKLY AVERAGES
Current Week
Previous 4 Weeks
1934 to Date
1933
0 5 10 15 20 25 30 35 40 45 50 55 60
Millions of Dollars
CUMULATIVE CAPITAL AND ENGINEERING CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1933 capital
1933 Contracts
1934 capital
1934 contracts
Millions of Dollars
PREVIOUS 4 WEEKS MOVING AVERAGE - CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1934 4 weeks moving average
1933 4 weeks moving average
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

BUSINESS SIDE OF CONSTRUCTION

Substantial Gain March Contracts Cost Index Rises Slightly

MARCH engineering awards, not including CWA expenditures, totaled $122,204,000. This 5-week's total represents an average of $24,441,000 per week, an increase of 23 per cent over February and 111 per cent over March, 1933, on dollar volume. The Volume Index (adjusted for cost rise) is 108 in March compared with 88 in February and 62 in March a year ago. In percentages these gains in the Volume Index are 23 per cent over February and 74 per cent over March, 1933, Both public and private awards contribute to this gain, the former a 7.8 per cent increase and the latter a 92 per cent gain. Federal awards gained slightly over February but were 46 per cent below January.

Highway awards continued at the February rate, 37 per cent below January; public buildings increased 46 per cent over February and 18 per cent over January; industrial buildings increased 370 per cent over February and 111 per cent over January; commercial buildings dropped 15 per cent below February but are 11 per cent over January.

Territorially the Middle West takes the honors of largest gain, with Middle Atlantic second. All territories are running well ahead of last year. Both New England and South show large gains over March 1933.

New capital

March saw renewed activity in PWA allotments, rather reallotments, adjustments on previous allotments and the reallotting of funds released by communities which have sold bonds elsewhere and changed their applications from loans and grants to grants only.

The municipal bond market continued strong but the larger issues were for refunding, relief, welfare or soldiers bonus. The number of productive capital issues was maintained but the average size was small and the volume of financing low for the month, $3,282,000 per week average compared with $6,156,000 per week in February and $3,580,000 per week in January when the strong bond market was just getting under way.

Materials notes

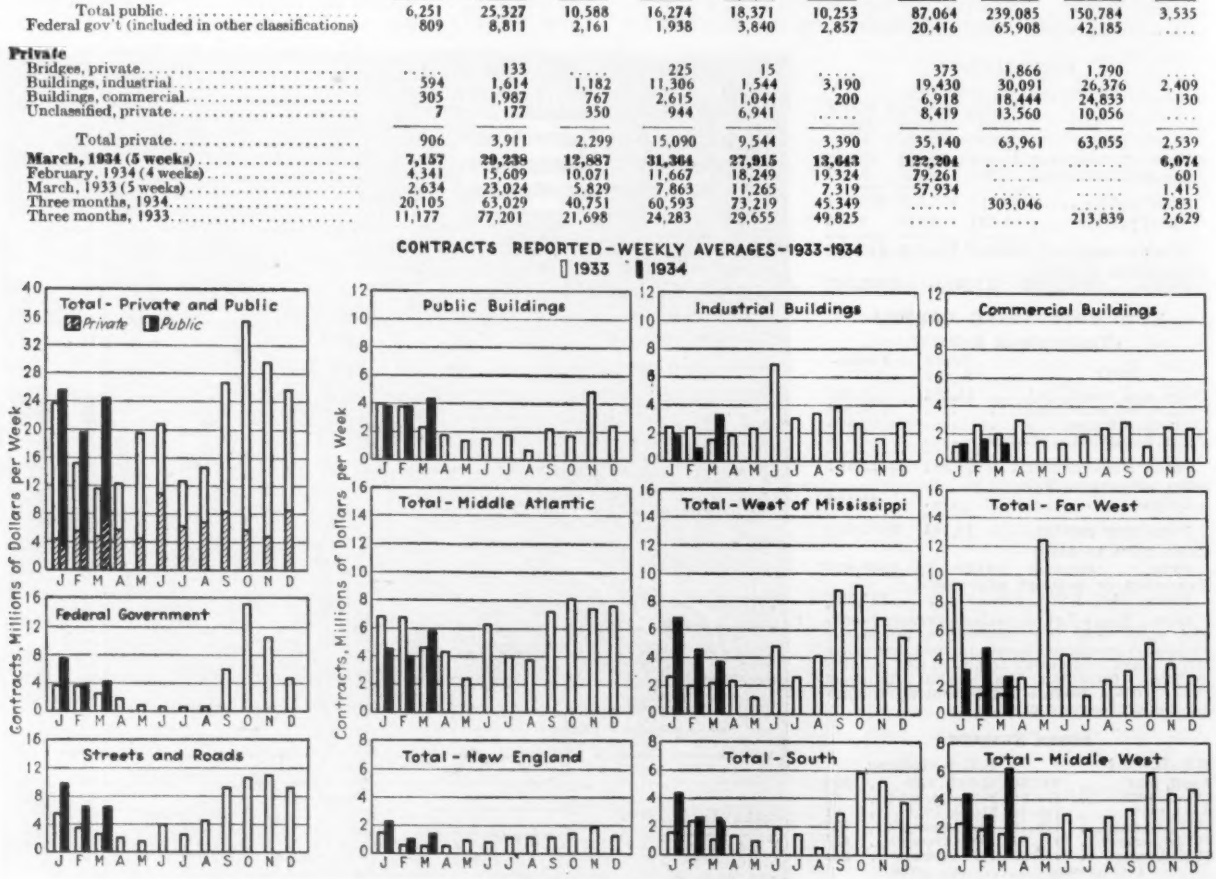
Clay products prices take their turn in the limelight of increases. Hollow tile is up at Chicago, Cleveland, Denver, New Orleans, New York, Philadelphia and Pittsburgh and down slightly at Atlanta and Boston. Pittsburgh has adopted a 5% discount for cash in 15 days on hollow tile. Cement is down at Atlanta 13c, Cleveland 5c, St. Louis 5c and up at Cincinnati 5c and Philadelphia 5c. New dealers delivery prices are in effect on building materials in several pricing centers

ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN MARCH, 1934

Five Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States March 1934	United States Three Months 1934	United States Three Months 1933	Canada March 1934
Public Works										
Waterworks	88	323	310	1,399	1,921	499	4,540	13,166	24,829	79
Sewers	816	179	536	2,972	402	210	5,115	10,736	4,084	111
Bridges, public	736	1,198	1,494	2,441	2,211	1,111	9,191	26,057	9,684	1,112
Earthwork and waterways	238	373	794	274	2,281	2,743	7,203	31,941	18,879	5
Streets and roads	931	2,764	5,656	7,153	9,843	5,045	31,392	96,088	49,279	2,057
Buildings, public	3,079	13,758	1,720	1,382	1,398	488	21,825	48,598	42,124	170
Unclassified, public	363	6,732	78	153	315	157	7,798	12,499	1,905	1
Total public	6,251	25,327	10,588	16,274	18,371	10,253	87,064	239,085	150,784	3,535
Federal gov't (included in other classifications)	809	8,811	2,161	1,938	3,840	2,857	20,416	65,908	42,185	....
Private										
Bridges, private	.....	133	.....	225	15	.....	373	1,866	1,790	....
Buildings, industrial	594	1,614	1,182	11,306	1,544	3,190	19,430	30,091	26,376	2,409
Buildings, commercial	305	1,987	767	2,615	1,044	200	6,918	18,444	24,833	130
Unclassified, private	7	177	350	944	6,941	.....	8,419	13,560	10,056	....
Total private	906	3,911	2,299	15,090	9,544	3,390	35,140	63,961	63,055	2,539
March, 1934 (5 weeks)	**7,157**	**29,238**	**12,887**	**31,364**	**27,915**	**13,643**	**122,204**	.....	.....	**6,074**
February, 1934 (4 weeks)	4,341	15,609	10,071	11,667	18,249	19,324	79,261	.....	.....	601
March, 1933 (5 weeks)	2,634	23,024	5,829	7,863	11,265	7,319	57,934	.....	.....	1,415
Three months, 1934	20,105	63,029	40,751	60,593	73,219	45,349	.....	303,046	.....	7,831
Three months, 1933	11,177	77,201	21,698	24,283	29,655	49,825	.....	.....	213,839	2,629

CONTRACTS REPORTED—WEEKLY AVERAGES—1933-1934



where price differentials are made on deliveries under 5 tons and those over 5 tons.

Extensive price adjustments are anticipated after April 8 when the present "modification order" of the Code expires under which the Builders Supply Trade has been operating.

Cement—Portland cement production in February was 4,168,000 bbl. compared with 2,777,000 bbl. in 1933 and 3,779,000 bbl. in January, 1934. The ratio of production to capacity was 20.2 per cent in February compared with 13.4 per cent last year and 16.6 per cent in January, 1934. Bids on Portland Cement taken by State Highway Commission of Wisconsin, March 9, 1934 averaged $2.075, 20c to be added for paper bags, 45c for cloth bags and a discount of 10c per bbl. for cash. Separate prices were bid for each county and ranged from $1.89 to $2.19.

Steel—Operating rate of steel companies having 98.1 per cent of the steel capacity of the industry was 45.7 per cent of the capacity for the week beginning March 26, compared with 46.8 per cent one week ago and 45.7 one month ago. This represents a decrease of 1.1 point or 2.4 per cent from the preceding week; a decrease of 0.5 point from the previous week and of 2.0 points from the first week of March. It is the same rate as reported for the week beginning Feb. 26. Bookings of fabricated steel were 18 per cent less than for January and 8 per cent less than the average monthly bookings of the last quarter 1933.

Lumber—Orders booked at the lumber mills during the week ended March 17, 1934 were less than during the two previous weeks but were still above the 200,000,000 feet mark, compared with an average of the first ten weeks of 1934 of approximately 173,000,000 feet, according to the National Lumber Manufacturers Association. Production during the week at 201,359,000 feet is the highest since August.

Labor

Employment in the production of six major construction materials as reported by the Federal Stabilization Board increased in February to 39.6 compared with 37.6 in January and 31.8 in February 1933. Adjusted for seasonal trends these figures are 41.9, 39.8 and 33.4 respectively. New York State Department of Labor reports declines in January in number of employees on building construction 8.4 per cent, highway construction 34.1 per cent, other general contracting 14.5 per cent, sub-contracting 7.4 per cent, or a total average decline of 14.7 per cent. This decline of 8.4 per cent on building construction employment in New York State was less than the 12.6 per cent decrease on public and private building construction not aided by public works funds which was reported for January by the U. S. Department of Labor.

Labor troubles centered around CWA strikes in March with several disputes settled. In New Jersey the chief counsel to the State Highway Commission gave the opinion that contractors encountering labor troubles which cause shut down in road construction and additional expense are entitled to compensation beyond the amount of the contracts. Under this decision the commission is required to pay the Hill Construction Co. of Mount Holly, $12,733.19 for "extras" and expenditures "necessitated by changed conditions." These latter included necessity to pay extra labor costs, furnish additional material and pay for extended machinery rentals. A strike threw work into winter working conditions. The Commission was directed to check up on the facts. CWA strikes through New York affected 4,500 men in Syracuse, 400 in Solvay, 350 in Rome, 200 at Batavia, 40 at Glens Falls and 2,000 at Buffalo. At Buffalo the men returned to work at a stone quarry when an order spreading their 24 hours over 5 days was withdrawn in favor of three 8-hr. days. Wages were not in question. At Rome men returned to work pending negotiations on wage rates or number of hours. In all other cases strikes were in protest against pay cuts. A one-day CWA strike in Harrisburg, Pa., ended with restoration of the pay cut that caused the strike call. At New Orleans common labor was reduced from 40c to 30c. In Moline, Ill., common labor rates for CWA work were reduced from 50c to 45c. Extended adjustments in skilled rates are reported at New Orleans, Moline, and Cincinnati. At Rochester, CWA rates are in accordance with prevailing union scales. In Columbus, Ohio, wages of city relief workers will be based on a minimum of 24 hours per week at 30c per hour. City workers on street repair crews at Columbus will be put on a 30-hr. basis. Transfer of CWA employees to the new Federal Emergency Relief Administration payrolls in Ohio on April 1 is being worked out on the basis of wages of from $30 to $50 per month.

General contractors of Lake Charles, La., adopted the following wage schedule in March: Common labor 40c per hr., painters 75c per hr., carpenters 75c per hr., plasterers, bricklayers, tile setters and skilled mechanics $1.00 per hr. A strike of iron workers on the Mathieson Alkali Works near Lake Charles was settled early in March by raising wages from 75c to 85c per hr.

At San Francisco the Board of Supervisors approved new mandatory wage scale for private employment on all public contracts to be effective for 6 months and representing an average increase of from 10 to 12 per cent. Structural iron workers returned to work on the state liquor store in Brighton, Ohio to finish that store, but the men will not work on future stores until a dispute is settled with the sheet metal workers' union over the erection of a metal counter. At Washington, D. C. work was resumed on a 100 per cent basis on the Department of Labor and Interstate Commerce Commission Buildings as cement finishers took over the job of laying mastic tile floors which was awarded to them by William Green, president of American Federation of Labor, arbiter in a jurisdictional labor dispute.

ENR Cost and Volume Index

THE *Engineering News-Record* Construction Cost Index for April is 195.86 a 0.9% increase over February and March due to an increase in cement and in the common labor average.

The *Engineering News-Record* Volume Index for March is 108, an increase of 23 per cent over February. This does not include CWA work.

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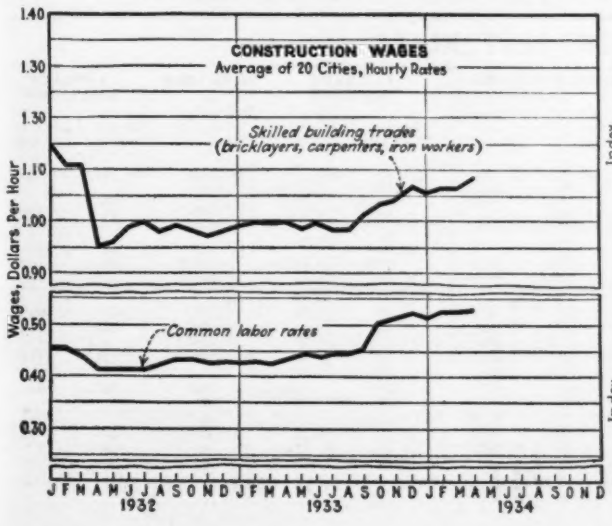

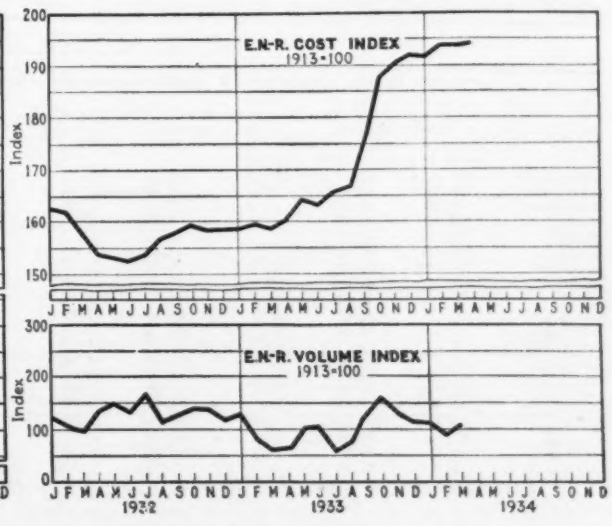

CURRENT PRICES OF CONSTRUCTION MATERIALS

CEMENT, AGGREGATES AND READY-MIXED CONCRETE

	PORTLAND CEMENT — Per bbl., carload lots, f.o.b. city, including cost of bags			SAND AND GRAVEL — Per ton, carload lots, f.o.b. city			CRUSHED STONE — Per ton, carload lots, f.o.b. city		CRUSHED SLAG — Per ton, carload lots, f.o.b. plant		CONCRETE — Ready Mixed 1:2:4, 50c.y. or more, delivered
	Cloth Bags*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	
Atlanta	$2.79	$2.54	$....	$2.31	$2.31	$1.64	$1.69	$1.92	$1.60	$1.60	$8.00
Baltimore	2.71	2.46	2.26	1.80‡	2.00‡	1.25‡	1.90‡	2.00‡	2.25	2.25	7.75
Birmingham	2.55	2.30	2.10	1.75	1.75	1.40	.....	.....	.90	1.15	5.20
Boston	2.72	2.47	2.27	1.50	1.50	1.10	1.50	1.50	.....	.....	6.50
Chicago	2.85‡	2.60‡	1.95	1.60‡	1.60‡	1.64‡	1.92‡	1.92‡	.....	.....	.....
Cincinnati	2.57	2.32	2.12	1.30	1.30	1.20	1.80	1.80	.....	.....	6.70
Cleveland	2.45	2.20	.....	1.55	1.55	1.45	1.65	1.65	1.75	1.75	8.85
Dallas	2.50	2.25	2.05	1.90	1.90	1.75	1.80	1.90	.....	.....	6.25
Denver	3.60‡	3.40‡	.....	1.85	.....	1.25	.....	.....	.....	.....	.....
Detroit	2.25	2.00	1.80	1.15	1.05	.85	.85	.85	.90	.90	5.75
Kansas City	3.14	2.80	2.25	.65	.65	.65	2.00‡	2.00‡	.....	.....	7.50
Los Angeles	2.90	2.65	.....	1.90	1.90	1.40	1.90	1.90	.....	.....	6.70
Minneapolis	2.75	....	2.30	1.00	1.00	.25	1.00	1.00	.....	.....	7.00
Montreal	.....	1.70	.....	.....	1.50	1.35	.....	1.25	.....	.....	.....
New Orleans	2.52	2.27	.....	1.70	1.70	1.40	.....	.....	.....	.....	7.75
New York	2.90‡	2.65‡	.....	1.50†*	1.50†*	1.00†*	1.75†*	1.85†*	.....	.....	8.00
Philadelphia	2.60	2.35	....	2.00‡	2.25‡	1.80‡	1.75‡	2.00‡	1.75‡	1.75‡	6.84
Pittsburgh	2.50	2.25	1.65	1.50‡	1.50‡	1.70‡	2.25‡	2.25‡	1.25	1.25	8.25
St. Louis	2.42	2.17	....	1.75‡	1.75‡	1.65‡	1.75‡	1.75‡	.75§	.75§	7.20
San Francisco	2.37	2.17	1.87	1.75	1.75	1.75	1.65	1.65	.....	.....	7.00
Seattle	2.95	2.65	.....	1.50†	1.50†	1.50†	.....	.....	.....	.....	5.75

*Includes 40c. per bbl. for bags, 10c. allowed for each returnable bag. †Per cu. yd. ‡Delivered. §F.o.b. Granite City, Ill. ▲Barge lots alongside dock.

CURRENT MILL PRICES CEMENT TO DEALERS, CARLOAD LOTS, F.O.B. MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Alpena, Mich	$1.65	$1.60	Ironton, Ohio	$1.60	$1.55	North Birmingham, Ala	$1.75	$1.70
Buffington, Ind	1.60	1.55	Iola, Kans	1.70	1.65	Richard City, Tenn	1.85	1.80
Crestmore, Calif	1.72	....	La Salle, Ill	1.60	1.55	Saginaw, Mich	1.65	1.60
Dallas, Tex. (Inc. 5c. tax)	1.80	1.75	Limedale, Ind	1.60	1.55	Steelton, Minn	1.80	1.75
Hannibal, Mo	1.60	1.55	Mason City, Ia	1.70	1.65	Universal, Pa	1.65	1.60
Hudson, N. Y	1.75	1.70	Norfolk, Va	1.76	1.71	Waco, Tex. (Inc. 5c. Tax)	1.80	1.75
Independence, Kans	1.70	1.65	Northampton, Pa	1.65	1.60	Wyandotte, Mich	1.60	1.55

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME

	STRUCTURAL CLAY TILE — PARTITION — Per M, lots of 2,000 pieces or over, delivered			STRUCTURAL CLAY TILE — LOAD BEARING — Per M, lots of 2,000 pieces or over, delivered			BRICK — Per M, in quantity, delivered		LIME — Per ton, in paper, carload lots, delivered		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverized or lump
Atlanta	$62.22	$66.38	$124.32	$189.50	$243.20	$277.90	$13.22	$13.50	$17.50	$12.10	$12.10
Baltimore	75.00	77.00	145.00	165.00	200.00	240.00	14.00	17.00	16.00	14.00	18.00
Birmingham	84.25	90.00	156.00	180.00	215.00	242.00	15.00	22.50	3.00§	1.75§	2.25§
Boston	88.40	94.30	176.90	200.40	248.00	283.00	14.00	16.00	17.90	13.60	19.00
Chicago	66.00	70.40	96.80	.....	.....	.....	10.20	11.20	18.00	12.80	12.80
Cincinnati	54.30	67.25	112.50	141.50	186.35	211.75	17.50	17.50	15.97	12.48	....
Cleveland	62.50	66.50	124.50	149.50	174.50	.....	17.50	17.50	19.60k	16.40k	2.65k§
Dallas	82.75	90.00	163.50	196.00	195.75	233.00	....	15.50	16.50	16.50	2.50§
Denver	78.50	88.00	141.50	166.50	196.00	225.00	11.50–15.50	21.00–30.00	30.00	22.00	....
Detroit	60.00	64.00	120.00	170.00	200.00	250.00	11.50	12.50	20.00	20.00	16.00
Kansas City p	62.50	75.00	140.50	155.00	.....	.....	13.50	18.00	.55‡	.45‡	2.61§
Los Angeles	77.50	94.25	134.00*	188.00	232.50	311.50	11.50	.....	18.70	.....	19.70
Minneapolis	77.00	84.00	143.00	165.00	173.00	240.00	13.10	21.00	25.50	21.00	21.00
Montreal	.....	110.00	.....	.....	260.00	.....	15.00	21.50	23.00	13.00	16.00
New Orleans	60.50	64.30	117.90	160.20	195.60	.....	14.00	.....	23.00	12.50	1.95§
New York	84.00	90.00	135.00	193.30†	238.80†	295.60†	14.00	.....	20.80	16.00	20.80
Philadelphia	79.00	84.00	158.00	189.00	243.00	301.00	15.00	18.00	16.35	11.25	10.75
Pittsburgh	58.50c	60.00c	115.00c	139.50c	161.00c	193.00c	17.50	22.50	16.69	14.10	16.66
St. Louis	65.00	70.00	130.00	150.00	170.00	220.00	15.00	18.00	.48‡	.38‡	2.10§
San Francisco	68.00	76.50	174.00	.....	.....	.....	14.00	16.00	22.50	19.00	15.50
Seattle	80.00	87.00	200.00	.....	.....	.....	15.00	17.00	30.00	25.00	3.00§

*6x12x12 in. †F.o.b. Perth Amboy, N. J. ‡Per sack. §Per bbl. kLCL. pPrice changes expected during April. cLess 5% cash 15 days.

ROAD SURFACING MATERIALS

	PAVING BRICK AND BLOCKS — Granite per M, lots of 50,000, 4x4x8 in., f.o.b. city	Brick per M, 3x8½x4 in., carload lots f.o.b. city	Wood per sq.yd., 3½ in., 16-lb. treat, f.o.b. city	PAVING ASPHALT — Per ton, less than 80 penetration, f.o.b. city Tank car	Drums	ASPHALT BINDERS—FLUXES — Per gal., 80-300 penetration, f.o.b. city Tank car	Drums	CUTBACK ASPHALT — Per ton, f.o.b. city Tank car	Drums	ROAD OILS — Per gal., f.o.b. city Tank car	ASPHALT EMULSION — Per gal., f.o.b. city Tank car	Drums
Atlanta	$3.00*	$35.00	$2.25	$18.20	$23.41	$0.0726	$0.0989	$20.45	$27.22	$0.0728	$0.105	$0.105
Baltimore	140.00	44.00	2.25	17.00	22.00	.07	.095	.08†	.115†	.....	.....	.....
Birmingham	65.00	24.00	....	18.00	23.00	0.778	.1028	.082†	.112†	....	.06	.....
Boston	99.75	32.00	2.25	18.00	23.00	.075	.10	.085†	.12†	.075	.09	.125
Chicago	145.00	42.00	....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cincinnati	115.00	37.00	....	17.40	21.40	.09	....	18.00	....	.07	.08	.11
Cleveland	115.00‡	36.00	2.77	18.50	22.70	.0725	.085	.075†	.0875†	.0475	.09	.1025
Dallas	.....	25.50	....	16.45	21.10	.0584	.0809	19.60	25.00	.0484	.1384	.1684
Detroit	.....	35.50	....	14.29	16.88	.....	.....	13.94	17.94	.....	.....	.....
Kansas City	.....	32.00	2.75	14.00	20.00	.06	.10	.08	.12	.06	.07	.09
Los Angeles	.....	48.50	....	12.00	16.00	12.00#	16.00#	14.00	.....	.042	.0525	.1125
Minneapolis	....	.....	2.50	20.10	24.10	.098	.098	21.75	34.35	.048	.....	.....
Montreal	....	100.00	....	14.00	19.66	.07	.093	19.00	26.50	.07	.125	.155
New Orleans	112.50	35.00	....	14.50	18.50	.065	.09	.07†	.10†	.....	.....	.....
New York	125.00§	47.50	2.64	17.00	22.00	.07	.095	.08†	.115†	.065	.085	.12
Philadelphia	110.00	45.00	2.02	15.00	20.00	.06	.....	.07	.10	.06	.....	.....
Pittsburgh	115.00	40.00	....	19.00	24.00	.0775	.1125	.086†	.121†	.0675	.....	.....
St. Louis	100.00	35.00	2.00	19.50	24.50	.0784	.1111	21.75	29.25	.0398	.09	.125
San Francisco	.....	45.00	....	12.00	18.00	12.00#	18.00#	14.00#	21.50#	.04	.08	12
Seattle	.....	47.50	....	18.00	23.85	18.00	23.10	15.00	.....	.03	19.20#	34.20#

Note: Paving asphalt, tank car or boat, f.o.b. Maurer, N. J., per ton, Bermudez, $25.00; Trinidad, $21.00. *Per sq. yd. †Per gallon. ‡4½x6x5½in #Per ton §4x5x9-in. Av.

CURRENT PRICES OF CONSTRUCTION MATERIALS

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES—PLATE Per 100 lb., carload lots	REINF. BARS Per 100 lb., ½-in. billet, carload lots	RIVETS Per 100 lb., ½-in. structural carload lots	WIRE NAILS Per 100 lb., base, carload lots	SHEET PILING Per 100 lb., base, carload lots	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	TRACK SUPPLIES Per 100 lb., carload lots: Angle bars	Std. spikes	Tie plates	Track bolts
Birmingham	$1.85	$1.95	....	$2.35	....	$36.375	$32.00	$31.00	$2.55	$2.40	$2.40	$2.40
Chicago	1.75	1.95	$2.85	2.35	$2.10	36.375	32.00	31.00	2.55	2.40	1.90	3.55
Pittsburgh	1.70	1.90	2.75	2.35	2.00	36.375	32.00	31.00	2.55	2.40	1.90	3.55

IRON AND STEEL PRODUCTS—LOCAL PRICES F.O.B. WAREHOUSE

	STRUCTURAL SHAPES Per 100 lb., base price	REINFORCING BARS Per 100 lb., ¾ in., base price: New billet	Rail steel	EXPANDED METAL LATH Per 100 sq.yd., carload lots: Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 s.f., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires Per sq.yd.	SHEET PILING Per 100 lb. base price
Atlanta	$3.34	$2.17	$2.02	$19.50	$22.50	$1.60	$1.21	$0.151	$2.45
Baltimore	2.85	2.70	2.50	18.50	24.00	1.46	1.12	.137	2.60
Boston	3.17	2.63	2.30	18.50	22.00	1.50	1.14	.142	2.32
Chicago	3.60	2.43	....	20.50	24.00	1.46	1.12	.137	2.00
Cincinnati	3.30	3.10	3.10	25.01	29.50	1.44	1.11	.135	....
Cleveland	3.06	2.95	2.22	18.50	22.00	1.44	1.11	.135	....
Dallas	3.85	3.60	3.50	27.75	32.50	1.70	1.27	.161	....
Denver	3.29	3.57	....	23.00	27.00	1.70	1.27	.161	....
Detroit	3.30	2.635	2.635	18.50	21.50	1.48	1.13	.139	2.165
Kansas City	3.75	2.82	2.63	19.00	....	1.54	1.17	.145	2.60
Los Angeles	2.95	2.80	....	25.00	30.00	1.90	1.40	.18	2.50
Minneapolis	3.35†	2.67†	2.52†	20.50†	24.00†	1.58	1.20	.149	2.40§
Montreal	3.25	3.00	2.80	....	....	....	....	....	3.30
New Orleans	3.50	3.00	....	19.50	23.00	1.58	1.20	.149	....
New York	3.27	2.52	2.37	20.50	24.00	1.54	1.17	.139	....
Philadelphia	1.905	2.19	2.04	18.50	22.00	1.44	1.11	.135	2.28
Pittsburgh	1.70‡	1.75‡	1.65‡	19.10‡	23.00‡	1.44	1.11	.135	2.00‡
St. Louis	3.34	2.815	2.665	22.25 & 18.50	21.50	1.46	1.12	.137	....
San Francisco	3.25	3.15	2.95	21.50	24.50	1.90	1.40	.18	2.40
Seattle	3.40	3.50	....	....	....	1.90	1.40	.18	....

†F.O.B. Customer's Plant. ‡Base Mill Price. Note: Shapes, bars and piling subject to quantity discounts. §Mill Price plus freight to Minneapolis.

PAINTS AND ROOFING SUPPLIES

	WHITE LEAD Per 100 lb. keg in oil, f.o.b.	READY-MIXED PAINT Per gal., drums, f.o.b.: Graphite*	Aluminum†	Ferric Oxide‡	ROOFING SUPPLIES Carload lots, f.o.b. factory: Rolls, slate surfaced, 85-90 lb., per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating, per gal.	Tar pitch, 350-lb. bbl., per ton
Atlanta	$11.50	$1.60	$2.10	....	$1.60	$2.70	$2.90	$ .325	$20.00
Baltimore	11.00	1.25	2.25	$2.00	1.70	1.60	1.80	.28	24.00
Birmingham	....	2.35	2.35	1.85	2.50	2.50	2.85	.55	23.00
Boston	11.50	1.50	2.40	.04x	2.05	3.50	3.50	.5625	23.00
Chicago	11.00	1.85	2.25	1.25	1.50	1.41*	1.41*	.23	20.00
Cincinnati	11.00	1.40	3.00	1.55	2.40	2.25*	2.25*	.36	25.00
Cleveland	11.00	1.65	2.35	....	1.50	50.00°	50.00°	.39	18.00
Dallas	12.00	1.90	2.10	1.50	2.17	1.98*	2.08*	.37	33.00
Denver	11.75	....	2.55	....	2.17	3.00	3.00	.50	30.00
Detroit	11.00	1.55	2.35	1.30	1.50	2.35	2.50	.40	20.00
Kansas City	11.12½	1.50	2.10	1.35	1.75	1.85	2.15	.30	26.50
Los Angeles	10.75	1.60	2.25	2.30	2.00	1.50	....	.45	....
Minneapolis	11.13	....	....	....	1.50	1.41*	1.41*	.2925	23.10
Montreal	9.40	1.70	3.45	1.65	....	2.62	2.02	1.40§	1.63§
New York	11.00	1.70	2.35	1.48	1.50	1.41*	1.41*	.232	20.00
Philadelphia	9.90	1.50	2.10	1.50	1.50	1.41	1.41*	.232	20.00
Pittsburgh	11.00	1.05	1.95	.80	1.90	1.65*	1.65	.31	23.00
St. Louis	11.00	1.85	2.25	1.25	1.67*	1.50*	1.50*	.27	20.00
San Francisco	10.75	....	....	....	....	....	....	.45	....
Seattle	10.75	....	1.92	....	3.10	4.50	....	.50	27.60

*New Jersey State Hwy. Spec. 120M. †ASTM Spec. D266-31. ‡80% maximum ferric oxide. °Per ton. §Per 100 lb. *Per roll, 65 lb. xPer lb.
Note: Red lead dry, same as white lead in oil, red lead in oil 50c higher.

MISCELLANEOUS ITEMS

WINDOW GLASS

Discounts from latest jobbers list, Sept. 15, 1928

	Single or Double Thickness: A quality	B quality
Atlanta	85%	85%
Baltimore	88%	90%
Birmingham	89%	90%
Boston	88%	90%
Chicago	87%	89%
Cincinnati	....	....
Cleveland	85%	87%
Dallas	....	....
Denver	84@ 5%	86@ 5%
Detroit	87@10%	89@10%
Kansas City	89@10%	89@10%
Los Angeles	90%*	90@40%*
Minneapolis	84%	86%
Montreal	....	....
New Orleans	88%	90%
New York	87%	89%
Philadelphia	88@10%	90@10%
Pittsburgh	86%	88%
St. Louis	87%	89%
San Francisco	90%	90@30%
Seattle	90@10%	90@20%

*Disc. from list Aug. 1, 1929. †F.o.b. Arsenal.

EXPLOSIVES

Per lb. dynamite delivered 50-lb. cases

	Gelatin 40%	60%
Atlanta	$0.215	$0.2375
Baltimore	.18	.195
Birmingham	.125	.140
Boston	.2225	.2375
Chicago	.17	.195
Cincinnati	.22	.245
Cleveland	.15	.165
Dallas	.30	.35
Denver	.19	.205
Detroit	.237	.255
Kansas City	.16	.18
Los Angeles	.1725†	.1925†
Minneapolis	.1725	.1875
Montreal	.1875	.2125
New Orleans	.19	.22
New York	.22	.235
Philadelphia	.215	.24
Pittsburgh	.105	.12
St. Louis	.13	.1425
San Francisco	.1575	.1725
Seattle	.1525	.1675

CHEMICALS

Water, sewage treatment, road work, f.o.b., carlots, New York:	
Bleaching powder, in drums, f.o.b. works, per 100 lb.	$1.90
Calcium chloride, 77-80%, flaked, in 400-lb. drums or 100-lb. moisture proof bags, f.o.b. works, freight equalized with points of competition, per ton	19.50
Chlorine, cylinders, per lb. delivered	.05½
Silicate of soda, 60 deg., in drums, f.o.b. works, per 100 lb.	1.65
Soda ash, 58%, in bags, per 100 lb.	1.25
Sulphate of aluminum, in 100 lb. bags per ton	27.00
Sulphate of copper, in bbl., per 100 lb.	3.75

PILES

Prices of Nichols Bros., 90 West St., N. Y. C., per linear foot, pine, with bark on, f.o.b., New York; delivered from barge, 1½ to 2c, per ft. additional:

Dimensions	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.09	$0.145
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.13	.195
12 in.—2 ft from butt	6 in.	60 to 69 ft.	.15	.215
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.185	.225
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.2025	.225
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.265	.375
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	.305	.442

RAILWAY TIES

Prices f.o.b., per tie, for carload lots:		6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Boston	Oak, untreated	$0.90	$1.20
	Pine, untreated	.90	1.20
	Pine, creosoted	1.35	1.85
New York	Long-leaf sap pine, untreated	.80	1.00
	Mixed oak, untreated	....	1.00
	White oak, untreated	.75	1.50
Birmingham	White oak, creosoted	1.40	1.45
	Southern pine, untreated "6x8x8'6"	1.00*	1.20
	Southern pine, creosoted	1.20*	1.40
Chicago	White oak, untreated	1.15	1.40
	Oak, empty cell, creosoted	1.50	1.88
	Oak, zinc treated	1.40	1.70
	Southern pine, creosoted	1.35	1.78
Los Angeles	Fir, untreated	.57	.80
	Fir, creosoted	1.75	2.50
Philadelphia	Red oak, untreated	1.00	1.50
	Red oak, creosoted	1.20	1.85
	White oak, untreated	1.10	1.55
St. Louis	Red oak, untreated	1.00	1.45
	Red oak, creosoted	1.40	1.95
San Francisco	Sap Pine or cypress, untreated	.90	1.25
	Douglas fir, green, untreated	.45	.63
	Douglas fir, empty cell, creosoted	1.14	1.56
Montreal	Birch or maple, untreated	1.00	1.00
	Birch or maple, creosoted	1.25	1.55

CURRENT PRICES OF CONSTRUCTION MATERIALS

WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton, f.o.b. 6 in. and over b. & s. class B and heavier, C/L lots*	VITRIFIED SEWER PIPE Per foot, delivered, standard 8 in., s.s.	12 in., s.s.	24 in., d.s.	36 in., d.s.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONC. SEWER PIPE Per ft., delivered; ASTM Spec. C 14-24 12 in.	24 in.	WROUGHT STEEL PIPE Full std. weight. Discounts from standard list for delivery from warehouse, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ¼ in., 9c; ⅜ in., 12c.; 1 in., 17½c.; 2 in., 37½c.; 2½ in., 59c.; 3 in., 77c.; 4 in., $1.10; 6 in., $1.94. 1 to 3 in., Black	1 to 3 in., Butt Weld Galv.	2½ to 6 in., Lap Wel Black	2½ to 6 in., Lap Wel Galv.
Atlanta	$40.00	$0.225	$0.405	$1.4625	$3.25	$80.00	$128.00	$0.625	$1.625	52%	44.5%	50%	42%
Baltimore	43.50	.33	.58	2.60	5.25	100.00	170.00	.75	2.00				
Birmingham	36.00	.25	.45	1.625	.....	85.00	.....	.....	.....	49.55%	36.23%	54.86%	43.95%
Boston	45.50	.294	.567	1.653	6.97	60.10	101.00	.49	1.85	.....	.....	.....	.....
Chicago	44.00	.35	.675	2.25	5.125	120.00	200.00	.675	2.25	.....	.....	.....	.....
Cincinnati	43.00	.224	.432	1.89	5.74	64.29	.....	.40	1.40	57.33%	46.31%	58.55%	47.53%
Cleveland	44.50	.217	.4185	1.845	5.945	47.25	72.00	.536	2.102	59.4%	48.4%	60.6%	49.6%
Dallas	48.00	.3325	.465	.....	.....	176.00	297.00	.60	2.27	.....	.....	.....	.....
Denver	56.00	.23‡	.415‡	1.73‡	.....	100.50‡	.....	.....	.....	.....	.....	.....	.....
Detroit	44.50	.28	.54	2.25	5.125	100.00	150.00	.....	.....	.....	.....	.....	.....
Kansas City	46.00	.33	.52	1.90	3.85	120.00	180.00	.....	.....	.....	.....	.....	.....
Los Angeles	44.50	.2825‡	.508‡	2.03‡	5.535‡	115.50	192.50	1.00	2.00	.....	.....	.....	.....
Minneapolis	46.50	.24‡	.432‡	1.728‡	4.35‡	65.00	120.00	.....	.....	$7.80–35.12	$9.67–43.55	$32.08–74.98	$38.21–90.70
Montreal	.....	.....	1.02	3.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Orleans	42.00	.28	.392	1.90	.....	45.00	.....	.45	1.65	.....	.....	.....	.....
New York	43.00	.35	.675	2.83	7.48	.....	.....	.55	2.00	56.164%	45.144%	57.389%†	46.368%†
Philadelphia	41.50	.28	.54	1.80	.....	135.00	210.00	.....	.....	56.65%	45.63%	57.88%	46.86%
Pittsburgh	46.00	.175‡	.3375‡	1.53‡	4.8175‡	46.00	82.00	.75	1.75	67.5%	58.5%	68.5%†	59.5%†
St. Louis	37.00	.27	.486	1.944	3.96	85.00	172.00	.90	2.28	55.796%	44.76%	57.021%	46.0%
San Francisco	44.00	.25	.45	1.80	4.50	112.00	170.00	.....	.....	60.1%	52.4%	62.4%	53.1%
Seattle	45.50	.35	.63	2.52	.....	84.00	200.00	.50	1.60	60.3%	51.3%	63.3%	52.3%
Burlington, N.J. (base)	40.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*Gas pipe and class A, $3 per ton additional, 4-in., $3 per ton additional. †3½ to 6 in. ‡f.o.b.

LUMBER AND TIMBER

		SHORT LEAF YELLOW PINE AND DOUGLAS FIR Per M ft. b.m., carload lots f.o.b. All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. All Fir planks No. 2 common; Fir timber is No. 1 common. Lengths up to 20 ft. 1x6, S4S	1x8, S4S	2x4, S4S	2x6, S4S	2x8, S4S	2x10 S4S	3x12 Rgh	6x12 Rgh.	12x12, Rgh.	LONG LEAF Y. P. Per M ft. b.m., C/L lots, f.o.b., merchantable grade up to 20 ft. 2x12, Rgh.	12x12, Rgh.
Atlanta	Southern Pine	$20.00	$21.00	$23.00	$20.00	$21.50	$22.00	$30.00	.....	.....	40.00	$45.00
Baltimore	Southern Pine	26.00	27.00	31.50	29.50	30.00	33.00	39.00			55.00	58.00
	Douglas Fir	28.50	29.50	32.00	31.00	32.00	33.00	33.50	$32.50	$32.50		
Birmingham	Long Leaf	30.00	30.00	33.00	33.00	33.00	35.00	60.00	.....	.....	42.00	60.00
	Southern Pine	23.00	23.75	25.75	22.00	24.50	25.50	28.00	.....	.....	.....	.....
Boston	Southern Pine	33.00	34.00	41.00†	41.00†	60.00‡	65.00‡	70.00‡	.....	.....	70.00	70.00
	Douglas Fir	32.00	32.00	41.00	41.00	42.00	43.00	42.00	42.00	42.00	.....	.....
Chicago	Southern Pine	29.00	30.00	35.00	31.00	32.50	34.50	45.00	.....	.....	54.00	58.00
	Douglas Fir	30.50	31.50	33.25	31.50	32.00	30.50	40.75	41.75	41.75	.....	.....
Cincinnati	Southern Pine	32.00	32.00	32.00	31.00	31.00	34.00	40.00	.....	.....	.....	.....
	Douglas Fir	.....	.....	.....	.....	.....	.....	47.50	47.50	50.00	.....	.....
Cleveland	Southern Pine	30.50	31.50	33.50	30.00	32.25	33.00	45.00	44.25‖	.....		47.00§
Dallas	Southern Pine	30.00	31.00	32.50	28.60	31.25	32.75	42.50	.....	.....	45.25	40.70
	Douglas Fir	.....	.....	35.00	33.25	33.25	33.50	41.50	46.00	46.00	.....	.....
Denver	Douglas Fir	.....	38.00*=	43.50*	43.00*	43.00*	44.50*	44.50*	49.00*	.....		
Detroit	Southern Pine	29.00	30.00	32.00	29.00	31.00	32.00	36.00	.....	.....	34.00	47.00
	Douglas Fir	.....	.....	.....	.....	.....	.....	44.00	45.00	47.00	.....	.....
Los Angeles	Douglas Fir	31.00	32.00	31.50	30.00	30.50	36.00	32.00	36.00	33.00	.....	.....
Minneapolis	Western Pine	49.50*	47.00*	43.50*	41.00*	41.00*	41.00*	53.25*‖	.....	.....	.....	.....
	Douglas Fir	46.50*	47.00*	42.75*	38.00*	38.00*	40.00*	49.75*	50.25*	53.25*	49.50*‖	.....
Montreal	Spruce	25.00	26.50	22.00	24.00	25.50	32.50	34.50	.....	.....	40.25	.....
	Douglas Fir	47.50	47.50	42.75	51.25	51.25	57.75	.....	.....	.....	.....	.....
New Orleans	Southern Pine	26.45	27.70	32.70	27.45	30.45	31.70	43.70	.....	.....	45.20	52.45
	Douglas Fir	28.00	30.00	33.00	28.00	32.00	33.50	37.50	.....	.....	.....	.....
New York	Southern Pine	35.25*	36.50*	39.00*	35.00*	38.00*Av.	39.00*	47.75	.....	.....	78.50*	77.25*
	Douglas Fir	44.75*	43.00*	43.00*	44.00*	40.00*	42.00*	42.00	40.00*	40.00*	.....	.....
Philadelphia	Southern Pine	27.50	28.50	30.50	27.25	29.00	30.25	35.00	.....	.....	66.00	64.00
	Douglas Fir	.....	.....	35.50	35.50	35.00	35.00	35.00	35.00	35.00	.....	.....
Pittsburgh	Southern Pine	26.50	27.75	32.75	29.25	31.75	32.75	41.50	.....	.....	57.50	57.50
	Douglas Fir	33.50	34.50	34.50	33.50	34.00	34.25	46.25	46.25	46.25	.....	.....
St. Louis	Southern Pine	38.00*	39.00*	41.00*	37.50*	40.00*	40.50*	53.50*	.....	.....	65.50*	74.50*
	Douglas Fir	.....	.....	.....	.....	.....	.....	57.00*	57.00*	57.00*	.....	.....
San Francisco	Douglas Fir	28.00	28.00	28.00	28.00	28.00	30.00	29.00	31.00	31.00	.....	.....
Seattle	Douglas Fir	22.50	21.50	21.50	21.00	22.00	22.50	20.00	20.00	22.00	.....	.....

*Delivered. †Spruce. ‡Long-leafed Y. P. §Norway Pine. ‖Northern Pine. ¶ Douglas fir. =Native. Av. Average.

CURRENT BUILDING AND CONSTRUCTION WAGE RATES PER HOUR

	Bricklayers	Carpenters	Structural Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const
Atlanta	$0.70/1.125	$0.40/.90	$0.60/1.25	$0.60/1.25	$0.50/.75	$0.30/.40	$0.30/.40
Baltimore	1.10	1.10	1.10	1.10	1.10	.45	.45
Birmingham	1.00	1.00	1.00	1.125	1.00	.30	.30
Boston	.90/1.30	.70/1.17½	1.20	.90/1.17½	.90/1.62½	.40/.70	.40/.70
Cincinnati	1.27½	1.02½	1.20	1.07½	1.27½	.45	.40
Chicago	1.50	1.31¼	1.35	1.31¼	1.50	.82½	.82½
Cleveland	1.25	1.12½	1.25	1.125	1.25	.72	.72
Dallas	1.12½	1.00	1.00	1.00	1.25	.40	.40
Denver	.60/1.12½	.60/.87½	.60/.87½	.60/.87½	.....	.50	.50
Detroit	1.00/1.10	.75/1.25	1.00	.70/90	1.25	.50	.50
Kansas City	1.32½	1.12½	1.12½	1.12½	1.32½	.60/.70	.62½
Los Angeles	1.00	.90	1.20	.90	1.00	.50	.60
Minneapolis	.90/1.00	.75	.90	.75	.90	.40	.50
New Orleans	1.00	.75	1.00	1.00	1.25	30./.40	.30/.40
New York	1.50	1.40	1.65	1.50	1.56¼	82½	.82½
Philadelphia	.75/1.20	.60/1.20	1.00/1.20	.75/1.00	.60/1.20	.30/50	.30/.50
Pittsburgh	.50/1.00	.50/1.00	.50/1.00	.50/1.00	.50/1.00	.35/.50	.35/.50
St. Louis	1.50	1.25	1.47	1.35/1.47	1.50	.78¾	.35/.78¾
San Francisco (6-hr. Day)	1.50	1.10	1.37½	1.12½	1.25	.75	.75
Seattle	1.20	.90	1.10	1.00	1.20	.60	.60
Montreal	1.20	.55	.85	.85	.85	.30	.20

Skilled Ave: (Bricklayers, Carp., Ironworkers) $1.0841. Common Ave. $0.5343¶